MARCH 1, 1949

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EQUIPMENT • FOR • PRODUCTION • SERVICE • MAINTENANCE

AUTOMOTIVE INDUSTRIES

IN THIS ISSUE

1949 Dodge and De Soto Models

Gas Turbine Development Facilities at G-E

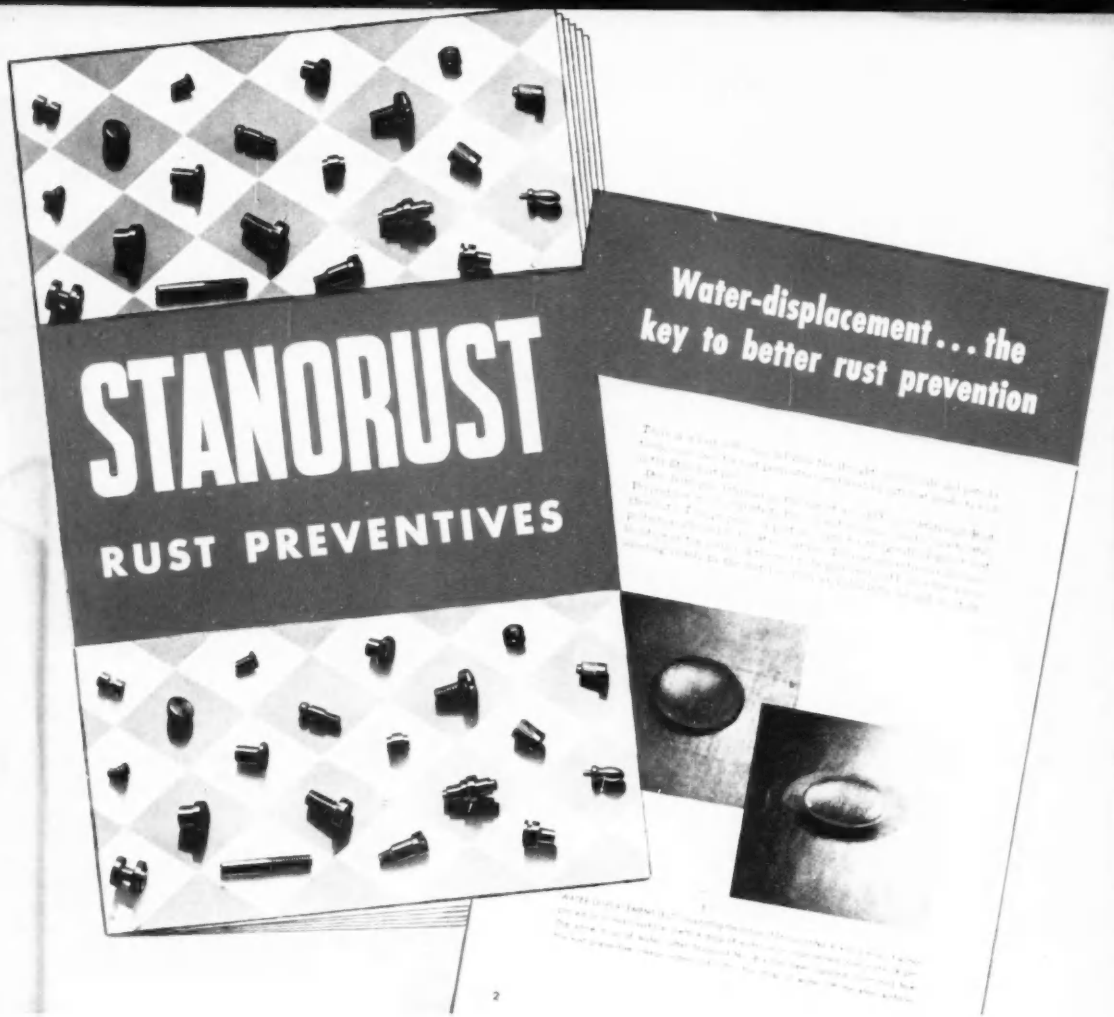
World's Largest Highway Transportation Unit

Advances in Fuel Mixture Methods

Oliver's Modernized Tractor Plant

Higher-Powered Blue Crown Racer for Indianapolis

Complete Table of Contents, Page 3



Here's the answer to your rust prevention problems

THE BOOKLET illustrated above holds the means to more complete and more economical rust control in your plant. It will help you analyze your rust prevention problems and needs. It tells how the new, improved Stanorusts now fully meet these needs.

The eight grades of Stanorust are described. They range from a fingerprint remover to a heavy, petrolatum-type product that protects against corrosion under the most severe outdoor exposure for years.

Find out why Stanorusts can mean big savings for you through better rust protection. Send for this booklet. Write for your copy today. Simply address your letter to Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

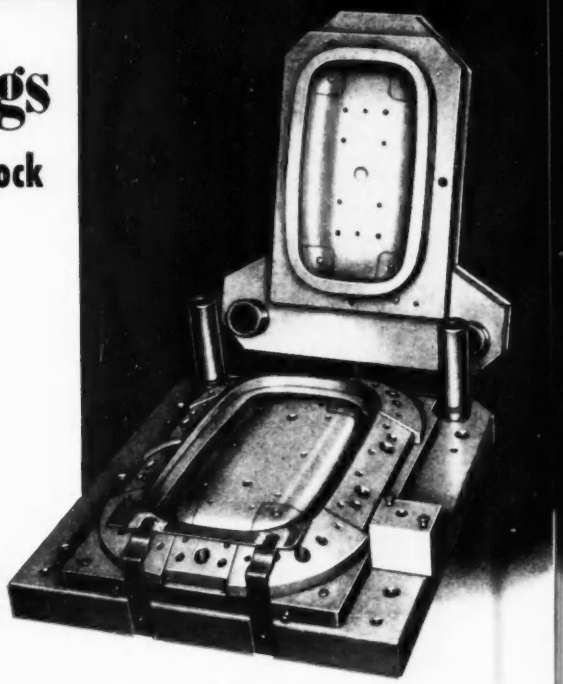
Send for a copy

STANDARD OIL COMPANY (INDIANA) STANDARD

Scratchless Stampings

Produced from 24-Gage Pre-Coated Stock

using DANLY *Precision* Die Set



Danly Precision Steel Die Set with dies used to blank and draw 14⅜" x 8" pan from 24-gage pre-coated lithographed cold rolled steel. Forming and curling are handled as secondary operations.

Drawing, blanking, forming and curling operations performed without marring satin-like finish

Here's an example of fine craftsmanship which is typical of the manufacturing methods employed by J. L. Clark Mfg. Co., Rockford, Ill. . . . producers of high quality lithographed steel ware.

Without marring or scratching the satin-like finish of pre-coated lithographed stock, the die illustrated blanks the center and produces an unusually smooth draw on this 24-gage steel pan. In a similar manner the edges are formed and curled in secondary operations.

Accurate punch and die relationship required

To assure accurate set-ups and precision results throughout, Danly 2-Post Precision Steel Die Sets are used, which are accurately machined top and bottom and equipped with leader pins and bushings lapped and honed to Danly precision standards. Because accurate punch and die relationship is maintained, full advantage is taken of the die makers' precision. The results are more stampings per grind, better product quality, and lower production costs.

Write for this *free* bulletin

Illustrates how you can use Danly's unusual machining service for special die sets to effect substantial savings in time and money.

save time { USE DANLY NATION-WIDE DIE SET ASSEMBLY SERVICE

Use Danly's specialized service to save time and money. Assembly plants listed below (marked with stars) stock interchangeable parts for quick assembly and delivery of any standard die set to suit your specifications.

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- ★ **Cleveland 14,** 1550 E. 33rd St.
- ★ **Dayton 2,** 990 E. Monument Ave.
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DANLY

DANLY MACHINE SPECIALTIES, INC.

2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS

25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

PRECISION DIE SETS...STANDARD AND SPECIAL • MECHANICAL PRESSES AND PRESS EQUIPMENT

JANE RUSSELL Starring In R K O's "IT'S ONLY MONEY"

This is more than just a Pretty Picture

OF COURSE . . . Jane Russell on her new Indian motorcycle is mighty attractive. *But* . . .

If you're a motorcycle enthusiast, you'll look further and see more. You'll find that the new Indian models are different—less than half the weight of former motorcycles—yet they deliver more horsepower per pound than any stock machine previously marketed.

Why? Some of the answers are illustrated at the right. To attain maximum *durability* and to build a *high-powered, light weight* and *safe* machine, engineers of the Indian Motocycle Company, Springfield 4, Mass., specified nickel alloy steels and irons for vital parts, including those pictured.

Centrifugally cast cylinder liners of nickel iron.
Transmission gears of 3115 type Ni-Cr steel
Indian crankshaft of 3140 Ni.Cr steel
3140 Ni-Cr steel connecting rods
EMBLEM OF INCO SERVICE

THE INTERNATIONAL NICKEL COMPANY, INC.

67 WALL STREET
NEW YORK 5, N. Y.

AUTOMOTIVE INDUSTRIES

Published Semi-Monthly

March 1, 1949 Vol. 100, No. 5

Contents

High Spots of This Issue ... 9

News of the Automotive Industries ... 11

A Practical Comparison of Mass Production Machines and General Purpose Machines. *By E. K. Morgan* ... 18

Hudson Adopts Latest Engine Balancing Technique ... 21

Advances in Methods of Mixture Preparation. *By P. M. Heldt* ... 22

Extensive Facilities Required for Developing Aircraft Gas Turbines. *By E. E. Stoeckly* ... 27

1949 Dodge and DeSoto Cars ... 28

Design Features of the World's Largest Highway Transportation Unit. *By L. M. Ballard and Ellis W. Templin* ... 30

Steel Balls Reduce Friction Between Spring Leaves. *By Herbert Chase* ... 33

Oliver's Modernized Facilities for Producing Three Tractor Models. *By Joseph Geschelin* ... 34

Blue Crown Special, Jr., Has New Engine and Rear Springing ... 37

Gould's New Laboratories ... 38

New Production and Plant Equipment ... 39

New Products ... 43

Publications Available ... 47

Personals ... 49

Calendar of Coming Events ... 51

Business In Brief ... 52

Aircraft Products ... 54

Advertisers' Index ... 62

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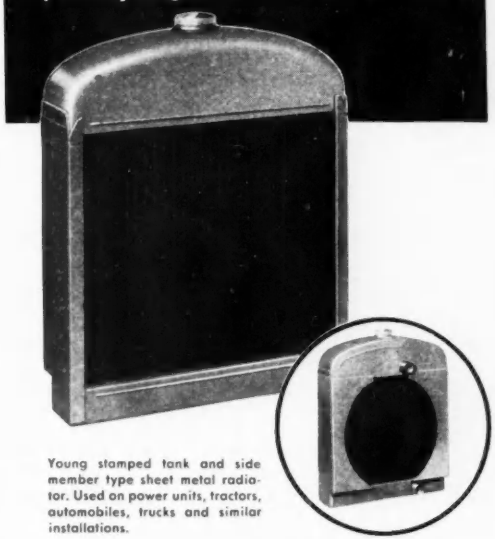
SHEET METAL RADIATORS

Specially Engineered ... Line Produced



Young stamped tank and side member type sheet metal radiator. Used on power units, tractors, automobiles, trucks and similar installations.

THERE'S A YOUNG RADIATOR FOR EVERY AUTOMOTIVE APPLICATION

Plant facilities, production skill, and engineering experience combine at Young to mass produce radiators with custom-built quality. Such primary considerations as: care in original design to insure proper mounting support for most rigorous service, careful design of tools for accurate fitting of all components, and latest equipment and techniques, add up to maximum efficiency at minimum initial cost. Young offers the advantage of two decades' specialized experience and recently enlarged production facilities to design and manufacture the proper heat transfer equipment to meet your requirements.

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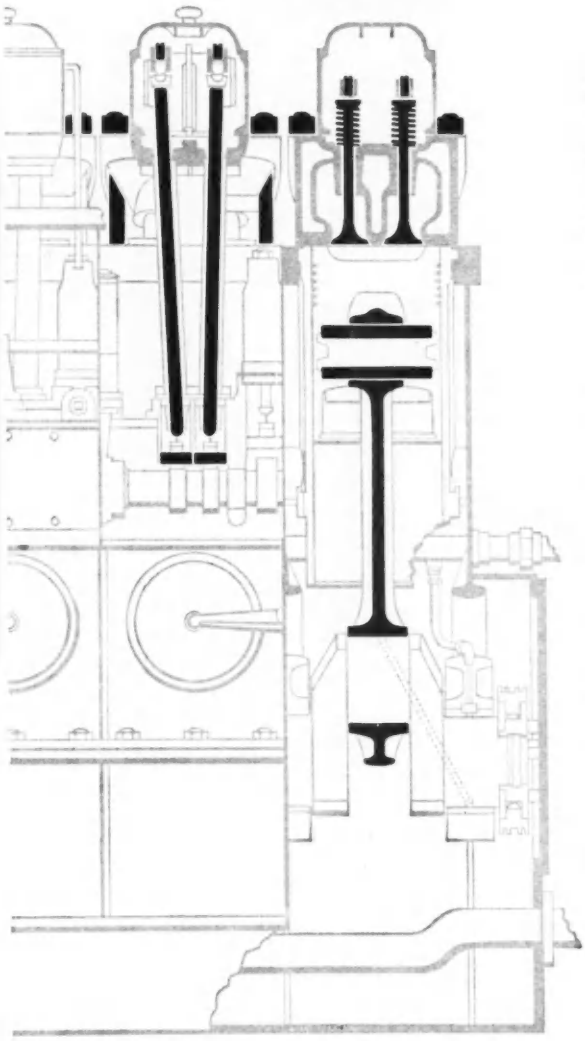
AUTOMOTIVE INDUSTRIES, Vol. 100, No. 5. Published semi-monthly by Chilton Co., Chestnut & 56th Sts., Phila. 39. Entered as Second Class Matter October 1, 1925, at the Post Office at Philadelphia, Pa.; Under the Act of Congress of March 3, 1879. In case of Non-Delivery Return Postage Guaranteed. Subscription price: United States, Mexico, United States Possessions, and all Latin-American countries, $2.00 per year. Canadian and Foreign $5.00 per year; single copies, 25 cents, except Statistical Issue (Mar. 15th), $1.00.

diesel bulk reduced

WITH ALLOY STEELS



It's no coincidence that the steady improvement in the efficiency and compactness of the modern diesel engine has been paralleled by a comparable increase in the use of alloy steel parts.

Alloy steels have many properties that can't be duplicated economically in other metals. They provide engine parts with the extra strength needed for higher working stresses. Smaller, lighter sections often do a better job than bulkier sections of ordinary steel.

Also, alloy steels may have the higher resistance to corrosion, to heat, and to wear that are so vital to the operation of a diesel engine. Parts last longer and maintenance is reduced.

Bethlehem manufactures the high-grade alloy steels used by many of the country's leading diesel builders. These steels are rigidly controlled through each stage of production. Every known precaution is taken to see that they meet the exacting requirements of the industry.

Besides producing the entire range of AISI steels as well as special grades, Bethlehem also furnishes metallurgical aid to diesel-engine builders. Advice and help concerning steel analysis, heat-treatment, forging or machining is readily available.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM ALLOY STEELS

added production...without adding brick and mortar

When a comptroller talks about investment cost necessary to increase the production of machined parts, maybe he is figuring in the cost of increased floor space, too.

Of course, *you* know that Acme-Gridley Automatics often double the production of an ordinary machine without taking up any more space. But it might help to remind him that the new Acme-Gridley Automatics may make even *more* floor space available in your present plant—that it is not unusual for one new Acme-Gridley to replace two or even four older machines.

Perhaps you will want to have some facts and figures to back up your story. Below is a typical certified case study. Would more of these—on 4, 6 or 8 spindle Chucking Automatics—help you? They're yours for the asking.

CUT THIS OUT FOR USE WHEN YOUR COMPTROLLER WANTS PROOF

AN ACME-GRIDLEY CERTIFIED CASE STUDY

THIS IS WHAT HAPPENED:

MACHINE—Acme-Gridley 12″ RPA 6 Spindle Chucker

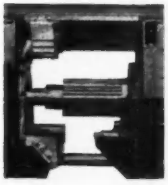
PART—6½″ Diameter Heat-Treated Malleable Casting

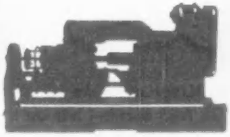
MACHINING TIME—For 18 operations, with tipped tools—one fifth of former method

Two Acme-Gridley 12″ RPA 6 Spindle Chuckers now complete this part in one handling, doing the work of 20 obsolete machines they replaced—*and reducing cost per piece by more than 70%.*

AND HERE'S ONE IMPORTANT REASON:

A wide, open tooling zone is characteristic of the Acme-Gridley design. There's plenty of space for time-saving, moneysaving, independently-operated attachments that often save second operations. And more room means easier tooling, easier loading, faster chip disposal. All these are important reasons for faster floor-to-floor times on Acme-Gridley chuckers.

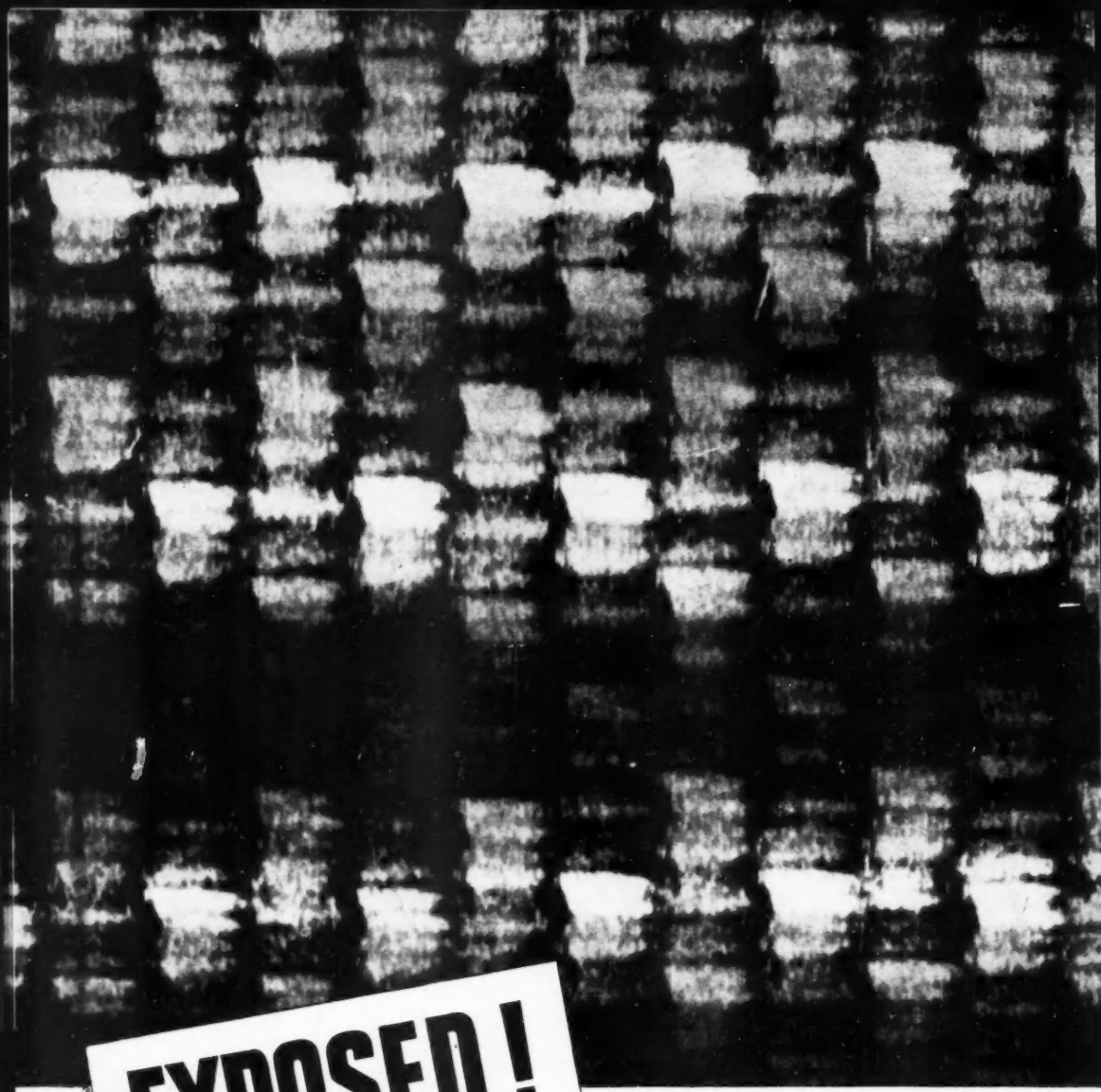




THE NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS built in 4, 6 and 8 spindle styles, maintain accuracy at the highest spindle speeds and fastest feeds modern cutting tools can withstand.



EXPOSED!

by SUPERFINISH

Here, in an enlargement of a 3/4" section, you see the grinding defects —*chatter and feed marks*—left on a ground surface which was previously considered acceptable. Partial Superfinishing shows them up. Complete Superfinishing will remove them . . . and produce a bearing surface which will last infinitely longer.

Superfinishing is a quick and inexpensive process which more than pays for itself in better performance, longer life and reduced service problems. The booklet, "Wear and Surface Finish," will be sent upon request. Please use your company letterhead.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

Lundberg Screw Products Co. makes *better* studs *at lower cost* with J&L ELECTREAT COLD-FINISHED STEEL BARS

J&L STEEL

Cutting precision threads on J&L Electreat Steel with a two-spindle threader at Lundberg Screw Products Co., Lansing, Mich.

Steel costs are reduced 20% to 30% . . . Heat treating of finished studs is eliminated.

Steel studs made by Lundberg for such equipment as truck axles, farm implements and diesel locomotives, must be made to exact specifications.

By using J&L *Electreat* cold-finished bars to replace higher-cost alloys, such as chrome-molybdenum and chrome-nickel-molybdenum, Lundberg not only meets the customer's specifications but also obtains *two savings: Steel costs are reduced*, and *the nuisance and expense of heat treating is eliminated.*

In addition finished studs are of better quality. They are free from scale and distortion caused by "batch" heat treating. They have clean, sharp threads. Inspection rejects are reduced.

Each bar of J&L *Electreat* cold-finished steel is individually heat treated at the mill by the electric-induction process under exacting control. The flexibility of heat control in the Electreat process permits "tailor-made" combinations of surface and core properties to fit *your* requirements.

Many fabricators of gears, couplings, bolts, nuts, shafts and other steel parts take advantage of these money-saving qualities of J&L *Electreat*. The booklet, "*New* J&L *Electreat* Heat-Treated, Cold-Finished Steel," compares the properties obtained by the Electreat process with conventional "batch" heat-treatment and points the way to greater profits. Let us send you a copy.

Jones & Laughlin Steel Corporation
430 Jones & Laughlin Building
Pittsburgh 19, Pennsylvania

Please send me a copy of "*New* J&L *Electreat* Heat-Treated, Cold-Finished Steel."

Do you recommend Electreat for:

NAME _____

COMPANY NAME _____

ADDRESS _____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

Bendix Products

BUILDERS OF THE BASICS OF

BETTER MOTOR VEHICLES

B-K* Power Braking System for Cargo Trailers
Bendix* Automatic Clutch and Gear Shift Control Systems
Bendix Hydraulic Power Steering
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Centermount Emergency and Parking Brake for Buses and Trucks
Bendix Vacuum-Power Gear Shifter

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Everything truck operators look for in power braking, they find in greater degree and for less cost in the Bendix Hydrovac*. It gives them easier, smoother, quicker stops with less physical effort. A record number of Hydrovac installations—over 2,000,000 at present—bears out this claim. Ask the man who uses Hydrovac about its performance . . . ask the man who services it about the upkeep . . . and you'll see why Hydrovac is first choice! This preference indicates the value of including Bendix Hydrovac power braking in your original equipment specifications.

*REG. U.S. PAT. OFF.

BENDIX PRODUCTS DIVISION of
SOUTH BEND 20, INDIANA

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The Authoritative Technical and News Magazine That Gives Comprehensive Coverage, Domestic and Foreign, of These Industries:

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AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off

High Spots of This Issue

Mass Production Machines Versus General Purpose Machines

Problems a manufacturer faces in selecting proper production tools are taken up in this practical article, emanating from the pen of E. K. Morgan, Vice-President of Giddings & Lewis Machine Tool Co. Avoidance of generalities in this analysis affords profitable to-the-point reading, page 18.

Hudson Adopts Latest Engine Balancing Techniques

A new dynamic built-to-order balancing machine detects, measures, and corrects vibrations caused by any unbalance in the Hudson Super-Six engine as assembled in the block. How this big piece of assembly line equipment—at production rates—licks problems of accumulated tolerances that may create out-of-balance conditions, is described beginning page 21.

Advances in Methods of Mixture Preparation

P. M. Heldt here discusses disadvantages of the float-feed spraying carburetor, virtually standard on passenger cars, which prepares the mixture outside of the engine cylinders. This account analyzes at length alternate merits of direct injection type carburetors as reported before the French Society of Automobile Engineers in a paper covering new techniques. See page 22.

World's Largest Highway Transportation Unit

A massive three-unit combination trailer, low bed trailer adapter, and tractor has been built for the Los Angeles Dept. of Water and Power. Its purpose is for over-the-road movement of mammoth generating machinery, construction equipment and electrical transformers up to a pay load capacity of 220,000 lb. Ultra-rigorous road testing of this motored monster and its surprising design features are related in the story on page 30.

Oliver's Modernized Facilities for Producing Three Tractor Models

A new final assembly building and rebuilt grey iron foundry now have specialized equipment of the latest type at the Charles City, Iowa, works of the Oliver Corp. Final assembly employs the straight line technique associated with mass production lines of the automotive industries. The full account appears on page 34.

32 New Product Items And Other High Spots, Such As:

The extensive facilities required for developing aircraft gas turbines; 1949 Dodge and DeSoto cars; how steel balls reduce friction between spring leaves; the new engine and rear springing found in the Blue Crown Special Jr. racing car; and Gould Storage Battery Corporation's new laboratories.

News of the Automotive Industries, Page 17

For Complete Table of Contents, See Page 3

NEWS *of the* AUTOMOTIVE INDUSTRIES

Vol. 100, No. 5 **March 1, 1949**

U. S. Car & Truck Sales in 1948 Hit All-Time Record

Although motor vehicle production in the United States last year was surpassed in 1929, sales of cars and trucks in this country hit an all-time record. Domestic sales last year amounted to 4,849,208 vehicles, compared with 4,624,658 in 1929. Although total sales in 1929 were 5,358,420, exports accounted for 733,762, whereas in 1948 the foreign market took only 436,217 units of the 5,285,425 total.

K-F Gets More Steel In Republic Deal

The Kaiser-Frazer Corp. has negotiated a new agreement with Republic Steel Corp. for the continued operation of the K-F blast furnace at Cleveland by Republic for the next five years. K-F will finance expanded facilities which will enable Republic to supply the automobile company with 7000 tons of cold rolled automotive sheet steel and 12,000 tons of pig iron a month at mill prices. Under the previous interim agreement, Republic operated the furnace and paid K-F a rental of $1.40 a ton for pig iron and coke produced, which was 10 cents a ton less than K-F's rental to the government, and also agreed to sell the company 5000 tons of pig iron a month at market price. According to Edgar F. Kaiser, K-F general manager, the agreement will eliminate much of the premium cost the company has previously paid for steel.

Model Changes Cut GM Output In January

GM production figures for January show a decline under the December levels due to model changeover by its Chevrolet and Pontiac divisions. GM turned out 149,028 cars and trucks, compared with 161,044 units produced in December. Of the total, passenger cars accounted for 99,916 units and trucks numbered 49,112.

Nash Starts Tooling for Automatic Drive

Nash has started to order tooling for the production of an automatic transmission. H. C. Doss, general sales manager, told dealers in announcement meetings when showing the 1949 models that a transmission has been tested and approved, and will be put into production after tooling is completed. It is understood that the automatic drive is not a torque converter but is a self-shifting device which is not like anything currently being offered by other manufacturers. According to the best information available, the transmission will probably not be in production until very late this year at the earliest, and it may possibly be 1950 before it is offered to the public. If Nash follows general practice, it will be offered first on the higher-priced Ambassador line.

Oldsmobile Announces Prices of 88 Model

GM's Oldsmobile Div. has announced prices for its 88 series, which has a chassis identical to the 76 model, but which is powered by the new V-8 overhead-valve Rocket engine. The prices for cars delivered at Lansing, Mich., not including transportation charges, state sales taxes or optional equipment, are as follows:

STANDARD MODELS	
Four-door Sedan	$2,286
Four-door Town Sedan	2,275
Club Sedan	2,212
Club Coupe	2,185
Convertible	2,601
DELUXE MODELS	
Four-door Sedan	$2,417
Four-door Town Sedan	2,406
Club Sedan	2,343
Club Coupe	2,316
Station Wagon	3,338

DELIVERIES BY REO

These new delivery trucks with commercial panel and metropolitan-type bodies, which are built by the Boyertown Body Works, Inc. and mounted on the new Reo Speed Wagon chassis, have been announced by Reo Motors, Inc. Two body types, the Merchandiser, shown at the left, and the Step & Serve ,shown at the right, are available. The obtainable combinations include the following: The Step & Serve S-7, a seven ft panel body mounted on a Reo chassis and cowl with 113-in. wheelbase; the Step & Serve S-8, an 8½-ft panel mounted on a Reo chassis and cowl with 125-in. wheelbase; the merchandiser M-9, a 9½-ft metropolitan-type body for a 113-in. wheelbase without cowl; and the Merchandiser M-11, an 11-ft metropolitan-type body for a 125-in. wheelbase without cowl. The bodies are made of alloy metal which is jig-assembled, riveted and welded.

SUN OIL COMPANY

announces

LUBEWAY

A trade-mark of Sun Oil Company

A COMBINATION HYDRAULIC OIL AND WAY LUBRICANT

LUBEWAY was developed in co-operation with leading machine tool builders for use in metalworking equipment in which the way lubricant is force-fed from the hydraulic system. Lubeway has been thoroughly "Job Proved" in industry. Send for free booklet containing complete information about this new product.

SUN OIL COMPANY • *Philadelphia 3, Pa.*
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Please send me your informative booklet on the new "Job Proved" Sun Product—LUBEWAY.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

SUN PETROLEUM PRODUCTS
"JOB PROVED" IN EVERY INDUSTRY

SUNOCO

NEWS *of the* AUTOMOTIVE INDUSTRIES

BUS BY BECK

Powered by the recently-introduced Model HR8-600 Cummins Diesel engine, developing 165 hp, this new 37-passenger Luxury Liner intercity bus has been introduced by C. D. Beck and Co., Inc., Sidney, O. The new Luxury Liner has a wheelbase of 219.5 in., and an overall length of 35 ft.

New French Motorcycle Shown at Int'l Car Show in NYC

At the First International Automobile Show held recently in New York City it was disclosed that foreign car makers expect to sell a total of 50,000 units in the United States in 1949, compared with 25,000 sold in the U. S. in 1948. To service the expected total sales in 1949, stockpiles of spare parts are being built up in this country, it was asserted. Among the nearly 100 different models of European cars, trucks and motorcycles was the newly-announced French Solex motorcycle. Weighing 58 lb, this motorcycle will be reportedly built in Detroit under French license for a market estimated at 50,000 units a year.

New K-F Utility Vehicle Lowest Priced in Line

Kaiser-Frazer has set the price of its new Traveler model at $2088.48, which includes factory installed accessories, but is exclusive of transportation, state, and local taxes. The price is $240 lower than the Kaiser Special, which is the next lowest priced car in the K-F line. The Traveler is a utility vehicle with a specially hinged back seat which folds down to make a flush floor extending from the rear of the trunk to the back of the front seat. The rear opens in two sections, with the upper half swinging upward from hinges located at the top of the rear window, and the lower half swinging outward and down from hinges at the bottom to make an extended loading platform. The spare tire is carried in the interior next to the left-hand rear door. When not in use as a utility vehicle and with the rear seat swung into position, the car has the conventional appearance of a four-door sedan for family use. The interior is trimmed in vinyl plastic. Production of the car is currently underway on a limited basis, and it will be introduced to the public in late March or early April. The company closed its plant Feb. 18 to prepare for volume production of the car and to take inventory adjustments. There is a definite possibility that K-F is going to make a bid for volume production with the Traveler, and in time, if the line is successful, it may surpass the regular passenger car models as the bread-and-butter car for K-F. A companion model, the Vagabond, is also about ready for production. It is very similar in design to the Traveler, but has more luxury features so far as chrome treatment and interior appointments are concerned.

Kurtis-Kraft Plans to Build New Sports Car

With tooling now being completed, Kurtis-Kraft, Inc., Los Angeles, Calif., builders of over 500 racing cars, is planning to produce a new sports car with a 100-in. wheelbase.

Buick Completes Revision Of Staff Organization

GM's Buick Motor Div. has announced further staff changes to round out its organization following the appointment last fall of Ivan L. Wiles as general manager. O. W. Young, who has been general manufacturing manager, was named to a newly created position of executive assistant to the general manager. He will be succeeded in his former post of general manufacturing manager by E. T. Ragsdale, formerly assistant chief engineer. Harry C. Doane and Richard C. Cook have been made assistant chief engineers under Charles H. Chayne, chief engineer. Both previously have been staff engineers.

HARD-TOPPED SPORT

The new Kaiser Virginian combines the lines of a convertible with the protection of a fixed all-steel top, which is concealed under padding and an outer sheath of vinyl-nylon. Powered by a 112-hp engine, this new sports model embodies the other features of 1949 Kaiser sedans.

Automobile Company Testing Smaller Lightweight Car

While all the talk about a smaller, lighter, lower-priced automobile is centered around activities of the Big Three, one of the independents has such a car in the works and has actually been testing it for more than two years. It is designed to be a "shopping car" with a small engine. It is not a midget car and in appearance would resemble the conventional-sized automobile. The hope is that it would be priced at least $300 to $400 under the standard car made by the company. The plans for its pro-

duction, of course, are very tentative and may never materialize, but it is an indication that the company is interested in the question of a budget automobile for persons priced out of the regular market.

GM's Cleveland Diesel to Build Plant Addition

GM's Cleveland Diesel Engine Div. has announced plans for the construction of a $2 million service parts building in Brooklyn Village, a suburb of Cleveland. With construction expected to start in 30 days, it is said that the new building will add about 150,000 sq ft of plant space.

Kaiser-Frazer 1948 Profit Three Per Cent of Sales

The Kaiser-Frazer Corp. had net earnings in 1948 of $10,362,098 on total sales of $341.5 million. The profit represents about three per cent of dollar sales. The 1948 return compares with net earnings of slightly more than $19 million in 1947; however, in 1947 there was no provision for income taxes required because of income tax credit carried forward from the previous year. The company reports that working capital at the end of 1948 had increased to $42,915,652, and net assets were up to $66,118,088. Also at the end of last year all tooling for the 1949 model had been acquired and paid for. During the year K-F completed a large plant acquisition program including a blast furnace in Utah and one at Cleveland, a steel mill in Pennsylvania, and substantial additions to production facilities at Willow Run and operating divisions. The company also negotiated purchase of the Willow Run plant and has made the initial downpayment. For the immediate future, at least, no further plant acquisitions are contemplated. Production last year was 181,000 cars, an increase of 37,000 over the previous year.

Stout Forecasts Functional Automobile Styling

Modern automobile styling with greater exposed surfaces calls for bumpers on the sides as well as the rear of the car, according to William B. Stout, well-known automotive and aviation designer and inventor. In a talk before the Detroit Section of the SAE in February, he said that he did not know whether bumpers will go all the way around the car, but that some protection along the sides will at least be necessary to protect the large areas of exposed sheet metal. He also said that a way to achieve more interior room for the passengers would be to make the entire rear seat movable so that it could be moved back into the trunk space which is used for luggage only about 10 per cent of the time. He predicted that rear windows will ultimately be placed above the heads of the passenger with a suitable rear view mirror, enabling the driver to see back at all times regardless of whether or not passengers are in the rear seat. Mr. Stout thinks that with the return of intense competition, automobile companies will be forced to bring out radically different cars in an effort to stimulate and expand the market, but he warned that the cars must not be merely radical, but must be much improved if they are to be successful. He pointed out that he was not particularly critical of the industry because he realized that it is not possible to get too far ahead of the public's taste.

Murray Corp. Dignifies Employment Interviews

The Murray Corp. of America is one of the more recent companies to remove the cold impersonal element from its hiring techniques. B. C. Gould, new Murray president, has instructed personnel employes to treat applicants with courtesy, attention and, most importantly, as an individual. Furthermore, applicants will not longer be referred to as a number, but will be addressed by their names. The employment office has been remodeled with clean cheerful decorations, and the old "hiring hall" benches have been replaced by comfortable individual chairs. Privacy of interviews is assured with private booths. Showing movies to applicants while waiting for their papers to be processed is another innovation. The films will show all phases of Murray activities.

Appel Leaves Willys To Join Ford

Walter D. Appel has left Willys-Overland to become vice-president in charge of engineering for the newly formed Ford International Co. which is to serve as a supervisory unit over foreign operations. He is well known in the automobile industry for his interest in and work on lightweight economy automobiles. Prior to joining Willys in 1946, where he subsequently became chief engineer, he had served with GM since 1925. He has had experience with Vauxhall in England, Adam Opel in Germany, and as chief engineer and later production development engineer of GM's Overseas Operations Div.

GM Publishes Dealer Building Book

GM is distributing to its dealers a new 150-page book dealing with the proper planning of buildings and layouts for sales buildings. It is the result

ONE FOR FIVE

Now being built by the La Crosse Trailer Corp., La Crosse, Wisc., from designs created by Brooks Stevens Associates, Milwaukee, this new five-car automobile transport features the use of powered hydraulic lifts which are said to permit the load to be handled by one man. Powered by a six-cyl, 112-hp Hercules engine, this trailer reportedly has a top speed of 70 mph.

of a prolonged research study including material gathered in a $50,000 architectural competition on the design of dealer establishments. Published by the service section of GM, the book contains information on the alteration and expansion of existing properties and the development of new properties. It covers such problems as exclusive truck operations, dealerships where the emphasis is on service rather than sales or where a gasoline station is part of the business, multiple-story buildings, adapting particular locations or lot shapes to a specific dealership, and a number of other special problems.

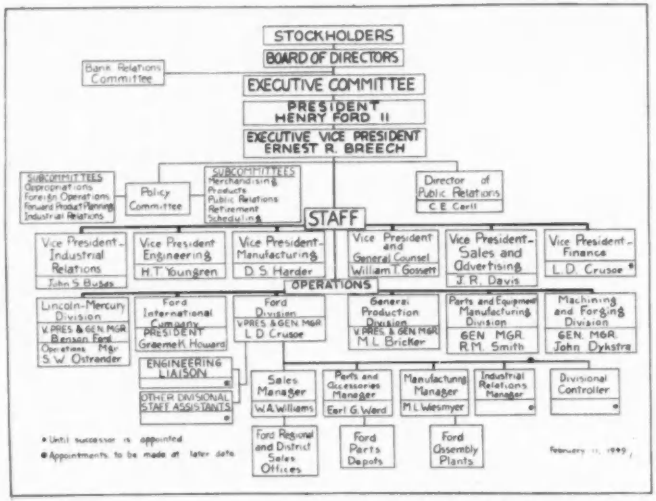
Improved Scrap Supply Helps Steel Outlook

One of the most encouraging signs that the steel supply will be easier this year is the behavior of the scrap market. Prices have fallen substantially since the first of the year, and the available supply appears to be increasing. One large automobile company reports that it has been requested by one of its steel suppliers to stop shipping its industrial scrap. The company had been previously proportioning scrap generated in its plants to its various mill sources.

Ford Motor Co. Forms Ford Division

Another step in Ford's decentralization plan was taken recently when Henry Ford II, president, announced the formation of the Ford Div. of the Ford Motor Co. All Ford assembly operations will be under the new division, and it will be responsible for the development, manufacture, and sale of Ford cars and trucks. Lewis D. Crusoe, who has been serving as vice president—finance, has been appointed vice president and general manager of the new division. M. L. Wiesmyer will remain in charge of Ford assembly operations as Ford divisional production manager. E. G. Ward will continue to be manager of all parts and accessories activities of the new Ford Div. W. A. Williams, who has been Ford general sales manager, has been named sales manager of the division, and he will continue to direct all Ford car and truck sales activities, including staff departments, and regional and district offices.

Mr. Ford stated that the company's staff heads will be relieved of much of the detailed operating problems, and that this will allow them to concentrate on staff duties, such as formulating plans and objectives, establishing policies and developing company-wide practices and procedure. The Ford Div. will report to general management in the same manner as other operating divisions of the company, such as Lincoln-Mercury and general production divisions. Staff officers of the Ford Motor Co. will continue to exercise functional supervision over these activities of all divisions of the company which are related to their particular areas of responsibility.


STOCKHOLDERS
BOARD OF DIRECTORS
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Ford International Company PRESIDENT Graeme K. Howard
Ford Division V. PRES. & GEN. MGR. L. D. Crusoe
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Parts and Equipment Manufacturing Division GEN. MGR. R. M. Smith
Machining and Forging Division GEN. MGR. John Dykstra
ENGINEERING LIAISON
OTHER DIVISIONAL STAFF ASSISTANTS
Sales Manager W. A. Williams
Parts and Accessories Manager Earl G. Ward
Manufacturing Manager M. L. Wiesmyer
Industrial Relations Manager
Divisional Controller
Ford Regional and District Sales Offices
Ford Parts Depots
Ford Assembly Plants
* Until successor is appointed.
Appointments to be made at later date.
February 11, 1949

ORGANIZATION OF THE FORD MOTOR COMPANY

Marking the first time an official organization chart of the Ford Motor Co. has been released, this chart shows the position of the new Ford Div. and Ford International Co. in relation to the operating divisions and the staff. As illustrated, staff vice presidents have functional supervision over those activities of the Ford Div. and of the other operating divisions which are related to their particular areas of responsibility.

Harry Ferguson, Inc. Operating at Profit

A financial report for Harry Ferguson, Inc., for the year ending Dec. 31 shows a net profit of $540,948 on net sales of more than $33 million. During the year the company built a large plant near the western edge of Detroit in record time and got into tractor production by Oct. 15. As a result of the Detroit operation, sales jumped sharply during the fourth quarter, with December alone accounting for nearly one-sixth of the year's total. Tractor production at the year end was more than 100 a day, which is considered an excellent performance in view of the fact that ground for the plant was not broken until mid-February. Output is expected to increase to 150 a day by March 1.

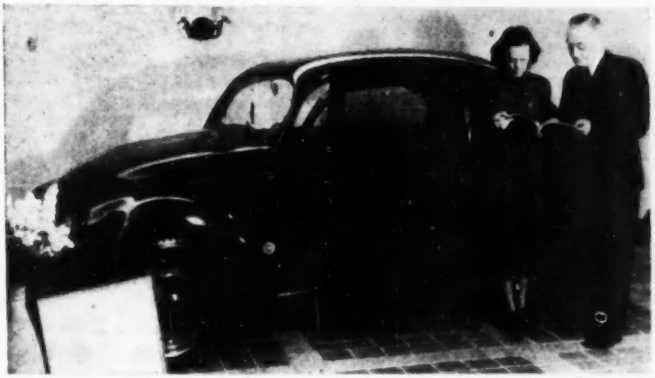
GM Rochester Products To Make Carburetors for '50 Chevrolet

Carburetors designed and developed by the research engineering department of GM's Rochester Products Div. have been authorized as standard equipment for 1950 Chevrolets, Thomas L. Lee, general manager of Rochester Products, has revealed. Rochester Products is preparing to tool up for mass production of the new units, and by next August expects to be turning them out in large quantities.

Edward F. Fisher Made Head of Gar Wood

Edward F. Fisher of the well known Fisher brothers family in Detroit has been elected president of Gar Wood Industries, Inc. He was a vice-president of GM and general manager of the Fisher Body Div. until he and his three brothers retired from active participation in the corporation in December, 1944. However, he is still a director of GM. Mr. Fisher invested $1.5 million in the Gar Wood organization more than a year ago. He succeeds Charles W. Perelle who had been president for 2½ years, and who had been instru-

NEWS *of the* AUTOMOTIVE INDUSTRIES



European

ON SALE IN BERLIN

Now producing this 1949 model, the People's Car Plant in Wolfsburg (British Zone), Germany, recently opened a branch in Berlin. This new model has an improved engine with a piston displacement of about 69 cu in.

mental in putting the firm on a profitable basis.

McCaslin Back at Willys As Purchasing Agent

Henry C. McCaslin, formerly vice president in charge of engineering for Kaiser-Frazer, has been appointed general purchasing agent at Willys-Overland Motors. The appointment marks his third association with Willys. He was with the company for three years as design engineer in the early '30's, returning to Willys as chief engineer in 1939. He resigned to join K-F in 1945 and left that company two years later.

Continental Motors Net Shows Big Improvement

The Continental Motors Corp. and consolidated subsidiaries earned a net profit of $3,378,123 during its fiscal year ended last Oct. 31. During the preceding fiscal year, the organization suffered a net loss of nearly $1.3 million.

Isotta Fraschini to Assemble Trucks & Engines in Brazil

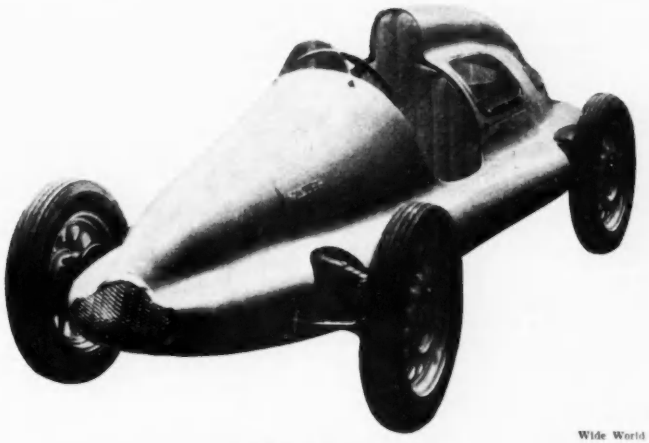
The Isotta Fraschini Co., Italian automobile manufacturer, has signed a contract with Brazil's National Motor Factory for the assembly in Brazil of 100-hp Diesel engines and seven-ton cargo trucks, with Isotta engineers supervising assembly. Isotta Fraschini parts are being shipped to Brazil for assembly with the understanding that there will be a gradual increase in the volume of parts manufactured in Brazil. The National Motor Factory operates a small modern plant about 25 mi from Rio de Janeiro on a government subsidy. It is estimated that about 50 trucks and 100 engines will be assembled monthly under the contract.

GM Expansion in Brazil Nears Completion

Within the next two or three months GM expects to complete an extensive expansion program at the GM do Brasil plant in Sao Paulo. Enabling GM do Brasil to concentrate its entire car and truck assembly in a new two-story building, 624 ft long and 361 ft wide, the expansion will permit the assembly of 15 units an hour on two assembly lines.

Chrysler Boosts 1949 Prices Average 6.7 Per Cent

The Chrysler Corp. has disclosed that its 1949 Plymouth, Dodge, De Soto, and Chrysler automobiles will average 6.7 per cent higher in price than the 1948 models. Without taxes or extra equipment, the factory retail price for the 1949 Plymouth short wheelbase de luxe three-passenger coupe is $1,295, compared with $1,272 for the 1948 Plymouth three-passenger coupe. The new small Dodge de luxe three-passenger coupe was listed at $1,525 as compared with $1,503 for the 1948 three-passenger coupe, excluding taxes and extras. Chrysler said that the price increases varied from $16.35 to $117 on the Plymouths; $22 to $122 on the Dodges; $139 to $143.50 on the De Sotos; and $141 to $252 on the Chryslers.



Wide World

BRITISH SPEEDSTER

Displayed in London recently, the new Marwyn racing car, shown here, is powered by an engine with a piston displacement of 30.5 cu in., mounted behind the driver. The complete automobile, ready to drive away, is priced at about $1780.

NEWS *of the* AUTOMOTIVE INDUSTRIES

TWO JET SERGEANT

Built by the American Helicopter Co., Manhattan Beach, Calif., the XA-5 Top Sergeant is powered by two pulsejet engines mounted on the tips of its rotor blades. Designed for a top speed of 75 mph, it carries a pilot and observer, and has range of 200 mi.

Chevrolet Chief Engineer Names Two Assistants

R. J. Waterbury has been appointed chief assistant engineer in charge of design — executive and administrative engineering for GM's Chevrolet Motor Div. He is one of two chief assistants announced by E. H. Kelley, new Chevrolet chief engineer. The other assistant is P. A. Collins who will be chief engineer in charge of production and experimental engineering. Both men are veterans with the organization. Mr. Waterbury started with Chevrolet in 1929 and since 1941 has been staff engineer on both commercial and passenger car bodies and sheet metal design. Mr. Collins joined GM in 1930 and became head of experimental engineering for Chevrolet in 1934.

Studebaker of Canada Starts Producing 1949 Models

Production of 1949 model automobiles has begun at the Studebaker Corp. of Hamilton, Ont., Canada, D. C. Gaskin, vice president and general manager, has announced. Mr. Gaskin also announced the addition of a variety of models to the plant's output. In March the de luxe two-door sedan and five-passenger coupe, and the Regal de luxe two and four-door sedan and the five-passenger coupe will be added to the passenger car line.

William Ford to Join Company as Official

William Clay Ford, son of Edsel Ford and grandson of Henry Ford, will join his two brothers as an official of the Ford Motor Co. early in March. Henry Ford II, company president, who made the announcement, said that his brother will spend considerable time in each of the staff and operating divisions before he is assigned permanently to a particular activity, and that his initial duties with the company will be in the sales and advertising department. The youngest of the three Ford brothers, who is 24, received his B.A. degree from Yale University recently. He has been a Ford director since June, 1948.

WAA to Sell Plants Leased to Timken

The War Assets Administration has announced that a manufacturing plant and a forging plant now under lease to the Detroit Timken-Axle Co. will be offered for sale. The manufacturing unit is adjacent to the main Timken-Axle plant in Detroit and cost the government $3.6 million. The forging plant is located at Melvindale, a Detroit suburb, and was acquired at a cost of $4.8 million.

1948 Passenger Tire Shipments Topped 63.5 Units

Manufacturers' shipments of passenger casings during the year 1948 totaled 63,516,542 units, a decline of 14.29 per cent from the all-time peak year 1947 when 74,109,453 casings were shipped. The Rubber Manufacturers Association, Inc., announced recently. Production of passenger casings in 1948 amounted to 66,780,127 units, and inventories were increased to 8,788,907. Shipments of truck and bus casings were lower during 1948, with 14,258,140 casings shipped, as compared with 17,073,911 during 1947. Production was down to 14,588,007 units against 17,754,837 the previous year. Inventories increased to 1,933,166 from the 1,505,221 casings at the end of the previous year.

Shipments of automotive tubes during 1948 were down to 68,457,397 units against 74,088,142 in 1947, while production of tubes amounted to 70,149,819 compared with 79,180,571 the previous year. Inventories rose from 8,059,315 units at the end of 1947 to 9,734,490 tubes at the end of 1948.

French Automobile Exports Down Nearly 11,000 Units

French automobile exports for the year 1948 totaled 73,062 vehicles, compared with 83,770 for the previous year. The total was composed of 54,969 passenger cars, 14,795 trucks and 3298 chassis. Although the number of vehicles dropped by nearly 11,000, the value increased by 7867 million francs. The French Union absorbed 28,833 automobiles of all types, an increase over the previous year, while foreign countries took 44,229, a decrease from 1947. Belgium was the biggest single purchaser of French automobiles, but the total, 10,535, was a drop of 10,369 from the previous year. Other countries in order of importance were Switzerland, Denmark and Holland, Brazil, Sweden,, United States (for which country the figure was 3025), England (for reexportation), Poland, Portugal and South Africa. Automobile imports into France totaled 2034, compared with 8626 in 1947. Passenger cars imported totaled 1596, trucks, 431, and chassis 7. The United States led for all types of vehicles.

Ford Completes Sales Force For English-Built Cars

Ford has completed its nation-wide force of dealers to sell British-built Ford cars and trucks. The company has appointed 34 direct dealers and 903 associates, all Ford dealers, as outlets for imported vehicles. The company says that stocks are now adequate to insure prompt delivery at all points where the cars are displayed and that additional orders will be forwarded to England only to cover stock replacement requested by dealers. Since the company started importing the cars in April of last year, Ford's share of the market in imported passenger cars has increased from about 10 per cent to approximately 50 per cent. More than 5000 cars have been delivered to cus-

tomers in this country since last April. A substantial number of Prefect model, a four-door sedan, are in service by cab companies in this country.

Bendix Aviation Buys Surplus War Plants

The Bendix Aviation Corp has purchased two government surplus aircraft plants at South Bend, Ind. The purchase price for the plants, which cost the government slightly more than $1.5 million, was reported as $1,050,000. The plants were operated during the war by Bendix.

Canadian Firestone Completing Plant Addition in Spring

The Firestone Tire and Rubber Co. of Canada, Ltd., has announced that the modern $1 million addition to its plant in Hamilton, Ont., will be finished early in the spring. W. H. Funston, president, said that the addition would provide 127,000 sq ft of space.

President Truman Appoints GM Official to Board

L. A. Danse, supervisor of materials and processes, production engineering section of GM, and chairman of the GM industrial waste committee, has been appointed to the Water Pollution Advisory Board by President Truman. He is one of six non-Federal members of the board to be appointed. He had been active in carrying out GM's program on smoke abatement and pollution of water sources by industrial wastes in GM plant cities.

NAVY FIREWORKS

The Navy's Douglas D-558-2 Skyrocket is shown here just after a jet assisted takeoff in what is said to be the first flight photograph of this jet and rocket-powered research aircraft. Douglas Aircraft designed and developed the plane in cooperation with the NACA and the Navy. The Skyrocket can take off under its jet power, climb to a high altitude, open its rockets to approach the speed of sound, and then land by turning on its jet power.

Rohr Aircraft Leases WAA Plant for Five Years

A portion of a government-owned aircraft parts plant in Chula Vista, Calif., has been leased for five years to its wartime operator, the Rohr Aircraft Corp., Chula Vista, the War Assets Administration has announced. The rent is $5132 monthly in advance. The portion of the plant leased consists of 13 acres of land and improvements, including six buildings with a combined floor space of about 250,000 sq ft.

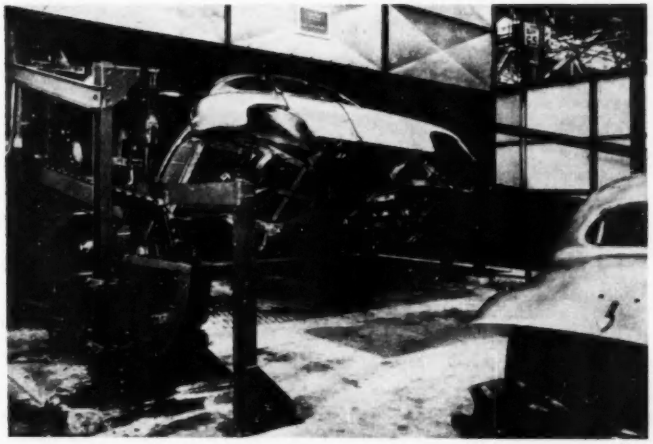
U. S. Rubber Names Green Fisk Tire Sales Chief

Wilson O. Green has been named sales manager of the Fisk tires div., United States Rubber Co., succeeding H. M. Ramsay who has been transferred to the U. S. Tire div. to supervise farm tire sales.

New Canadian Jet Engine Being Tested

A new Canadian jet engine, the Orenda, recently underwent its first test runs at the A. V. Roe and Company, Ltd., plant at Toronto, according to an official announcement by Honorable Brooke Claxton, Minister of National Defense. The Orenda engine is of the axial-flow type, and is being groomed as a possible power unit for the long-range jet-fighter under development for the RCAF, also by the Roe Co.

(*Turn to page 53, please*)



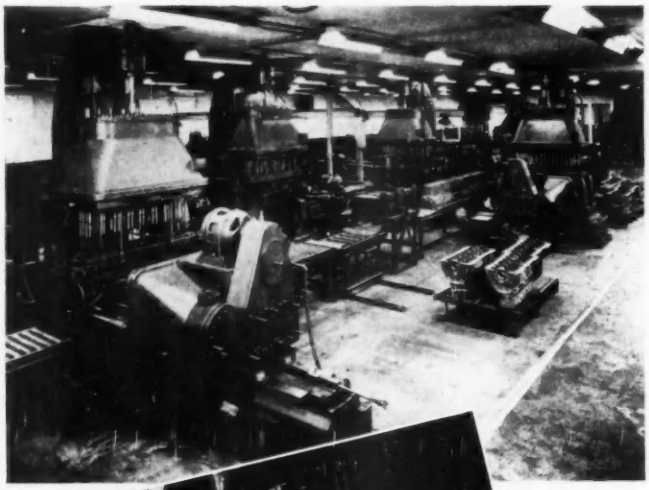
Asmo

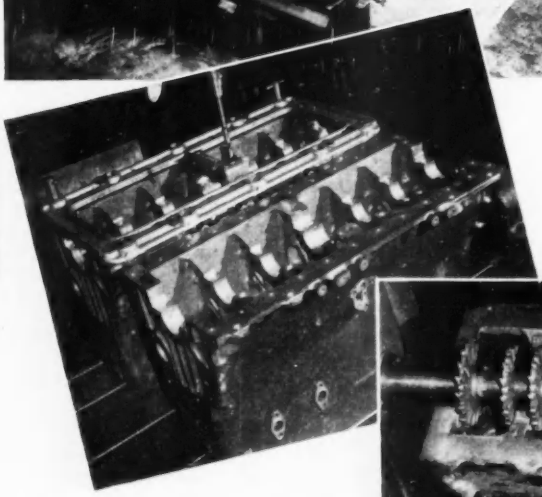
DONE TO A TURN

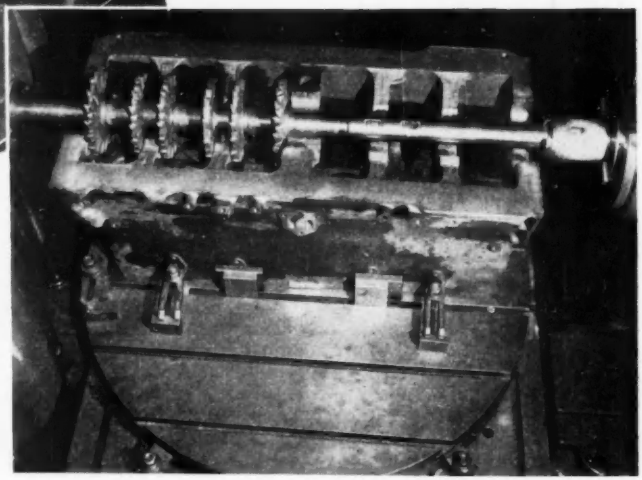
In this plant near Coventry, England, operated by Fisher and Ludlow, a subsidiary of Standard Motors, automobile bodies are strung on a revolving rod to pass through a rust-protecting process termed Rotodip. The bodies are rotated evenly through six tanks containing cleaning liquids and phosphates, and are then passed through a hot air drying oven into the paint compartment.

A Practical Comparison of

Mass Production Machines







Presented Here Are Typical Situations in Which General Purpose Machine Tools and Mass Production Equipment Were Used in the Production of Diesel Engine Cylinder Block and Crankcase of Integral Construction. Important Basic Factors for Each Type of Equipment and Costs of Production Are Discussed in This Article.

(Top) On a mass-production basis blocks are drilled and tapped progressively on this transfer line of six multiple-head, multiple-spindle drilling and tapping equipment.

(Above) This drilling operation on a radial drill press is a contrast to the line production method where a multitude of holes are finished in a single setup.

(Right) Here is the general-purpose machine setup on a horizontal boring machine for milling the side surfaces of main bearing seats.

and General Purpose Machines

By E. K. Morgan Vice President, Giddings & Lewis Machine Tool Co.

WHEN a manufacturer is confronted with a production problem, he seeks to determine:

1. Whether a straight production setup employing a line of specialized machine tools will answer immediate and future needs.

2. Whether a number of general-purpose machines will have the necessary capacity to take care of urgent as well as anticipated requirements.

3. Whether a combination of both types of equipment will prove to be the most satisfactory for solving the machining problem now and later.

To avoid a discussion of generalities about both classes of equipment, factors of comparison will be discussed in detail to show what must be considered when choosing machine tools. Attention then is directed to these factors, and in the first group appear:

Selection.

Origin of machining methods.

The unit or product to be produced.

The operations performed on the product.

Quality of finished product.

This list is basic and establishes the nature of the product and the problem.

In the second group of comparative factors are:

Number of cylinder blocks required to meet production demands.

Number of machines necessary to produce required blocks.

The operators required for each class of machines.

The skill or type of operator needed to operate the machines.

Estimated annual productive machining time.

Presenting this breakdown indicates details about the production, the men and the time which is necessary in making the comparison.

The third group of factors deals with:

Equipment flexibility in producing different cylinder block models.

Relative amount of floor space required for each type of equipment.

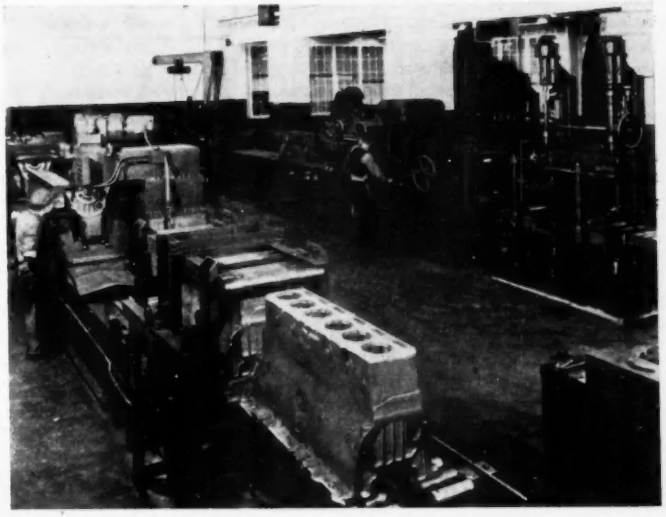
Relative investment for each class of equipment.

Length of time required to amortize the investment.

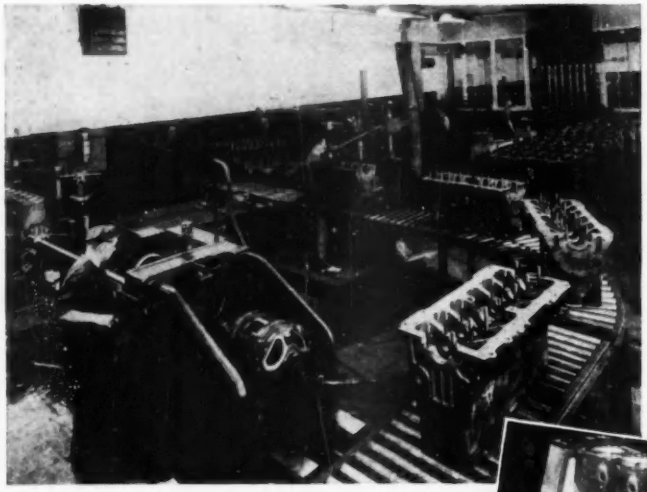
Relative cost of blocks with tangible factors taken into consideration.

A fourth group of factors also has been added. These will be discussed as intangible "IF" factors which bear upon the situation. These are conditions, direct or indirect, that assist in determining the profitable and successful operation of equipment. While such factors are not as concrete and definite as those previously outlined, they must be considered in the overall comparison.

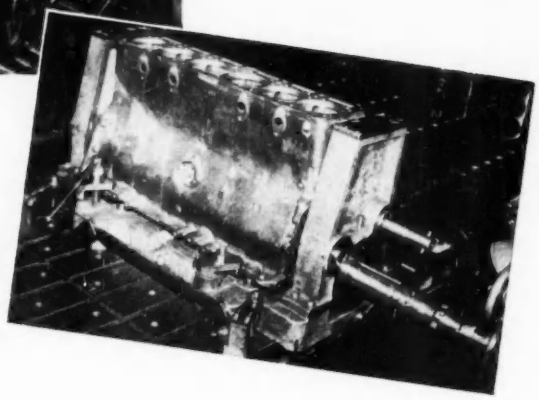
The conventional designed six-cylinder Diesel engine cylinder block with integral crankcase, used as the example here, was completed on both general-purpose and mass-production machines. The opera-



This is a section of the mass-production cylinder block milling department, equipped with seven multiple head type milling machines.



(Left) The mass-production equipment in this group of machines includes a multiple-spindle machine for boring crankshaft and cam shaft bearing seats, shown in the foreground, a small hand drill mounted on a swing arm in the center of the picture, and a multiple-spindle cylinder boring machine in the background.



(Below) The block shown here is set up on a horizontal boring machine for boring crankshaft and cam shaft bearing seats. Obviously, the skill of the operator is a determiner of accuracy to a greater degree in this method of production than in mass-production equipment where the control of accuracy is incorporated in the machine once it is set for a particular job.

tions performed on the blocks include all necessary machining. In the 26 different operations, both classes of equipment milled all required surfaces, pads and bosses; drilled and tapped various holes; bored main and camshaft bearings and bearing caps; bored cylinder liner seats. Simple drill jigs were used with the radial drilling machines to speed their work.

In machining the block, it is important to keep in mind the quality of finish and degree of accuracy along with the operations performed. It is obvious that general purpose machines, in final analysis, will produce quality blocks in direct ratio to the skill and ability of the machine operator who is able to duplicate units only so far as the human element permits. On mass-production machines duplicate units are made exactly to the mechanical limitations of the line machines. The human element is a minor factor in determining the quality of the finished product, but it does affect the number of units produced.

Original production plans required that line equipment produce three blocks per hr for one eight-hr shift, or a total of 24 blocks for the work day. This production was easily met and while demands may have required a second shift, it was not the manufacturer's desire to increase production in this way even though capacity was available.

Production of blocks on general-purpose machines was eight units per day around-the-clock. By working three eight-hr shifts enough blocks were produced to handle the emergency. This served as a stopgap to take care of the situation until the production line was ready.

The number of machines necessary to produce the required one-third block per hr around-the-clock on general-purpose machines was: Four table type horizontal boring, drilling and milling

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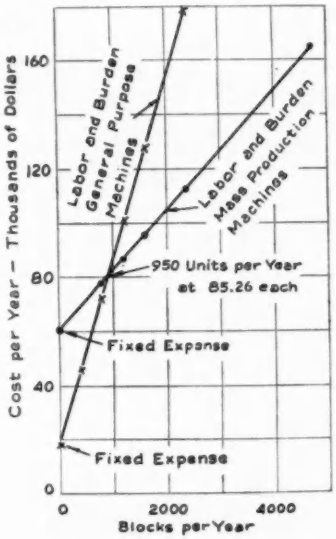
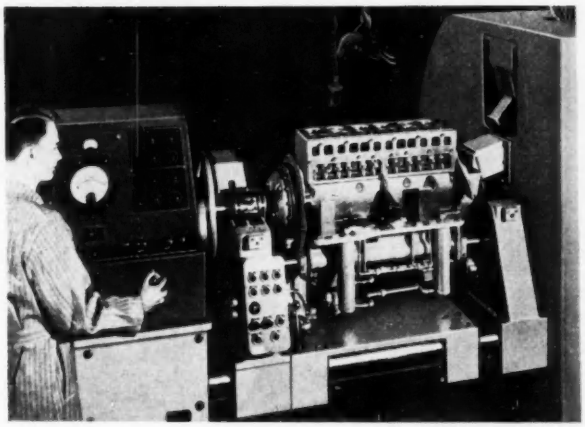


Total cost per block at varying rates of production on general-purpose machines and mass-production machines.

Hudson Adopts Latest Engine Balancing Technique



View of one of the new Gisholt Dynetric balancing machines, showing a Hudson six in the cradle. The main control panel is at the extreme left.

ANOTHER major forward step in engine building technique has been taken by Hudson with the introduction of a new dynetric balancing machine, built to order for the company by Gisholt for detecting, measuring and correcting the vibration caused by any unbalance in the Hudson Super-Six engine as assembled in the block. Based upon an average production of 40 six-cylinder engines in an hour, Hudson has installed two balancing machines, one on each side of the final engine assembly line, each being capable of balancing 20 engines an hour.

As illustrated, the balancing machine is a big piece of equipment. From the standpoint of the user its major elements are; the control cabinet at the left with operator controls and instrument for reading balance at the front and rear end of the engine, the balancing cradle in the center in which the engine is mounted, and the drilling station at the extreme right for balance drilling the vibration damper. There is another drilling head to the left of the cradle for balance drilling the clutch end.

In introducing this latest technique Hudson has attacked the problem of accumulated tolerances that may create out-of-balance conditions. For example, Hudson balances the crankshaft by itself, in Gisholt Dynetric balancers, to a tolerance of 0.3 oz in. (Max.). Similarly the rotating elements of the clutch as well as the flywheel also are separately balanced. Pistons are machined to a standard weight while connecting rods are weighed and balanced to predetermined tolerances.

With the new machine the completely assembled system can be dynamically balanced as a unit. With corrective drilling at either end or both ends, depending upon conditions, it can be balanced at production rates to a tolerance of ½ oz-in. for the entire line comprising the crankshaft, piston and rod assemblies, damper, flywheel, and clutch assembly. The machine can detect unbalances in a much smaller degree than the ½ oz-in. to which correction can be made. This operation is done, as illustrated, while the engine is in its initial sub-assembly form, i.e., just before the cylinder head, oil pan, and valve cover plates are installed.

The engine is lifted off the gravity roller conveyor line at the side and dropped into the balancer cradle by means of an overhead-mounted hoist. It is installed with the clutch end at the left and is driven by means of a spline shaft which comes into action from the left at the proper time. The engine is lined up on dowel holes in the crankcase and is hydraulically clamped in place. When clamped the engine becomes a part of the cradle, the entire unit being freely suspended on wires at each of the four corners.

As the engine revolves the minute vibrations that would tend to vibrate the engine in actual operation in a finished automobile set up enormously magnified vibrations on the suspending wires of the cradle.

The machine has an intricate system of electric safety interlocks to assure the proper sequence of operations and to prevent accidental damage. When the machine is started by the operator the engine is driven at a constant speed of 450 rpm and readings of unbalance are taken at this speed. The electronic control equipment records the out-of-balance reading at both ends and determines how much correction is necessary and where corrective drilling should be applied.

If balance is correct initially within the specified standard, the engine is removed and replaced on the conveyor for final assembly. If correction is required at either end or at both ends, the operator sets the machine for the drilling cycle, one end at a time. The

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Advances *in Methods of*

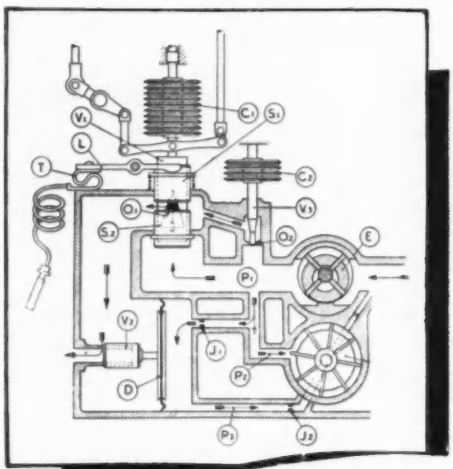

Fig. 1—Schematic drawing of Hobson injector carburetor

So far as passenger-car applications are concerned, the float-feed spraying carburetor has become virtually the universal standard. It has been gradually improved by such additions as the choke to facilitate starting, the accelerator pump to permit rapid opening of the throttle without causing the engine to gasp or starve, and the economizer to combine maximum output under full throttle with a reasonable fuel economy over the greater part of the output range. But while these improvements have materially bettered the operating characteristics of the engine, the conventional method of fuel supply or mixture formation is far from being perfect. Its shortcomings are partly inherent in the method of forming the combustible mixture outside the engine cylinders, and partly in the mode of operation of the carburetor, which usually has at least two ranges, an idling-nozzle range and a main-nozzle range.

In the case of multi-cylinder engines, preparing the mixture in a device outside the engine leads to distribution difficulties, especially under conditions of low load, when the suction force is small, with the result that the fuel is not very finely pulverized. Under such operating conditions the different cylinders receive mixtures of different strength or richness, and since the leanest charge must be sufficiently rich to be ignitable, charges in some of the cylinders will be over-rich, which results in a waste of fuel.

With the conventional automobile carburetor the idling nozzle supplies all or most of the fuel up to car speeds of about 15 mph. At a point somewhat below this speed the main nozzle becomes active, and as the speed increases it gradually takes over from the idling nozzle. The delivery of each nozzle varies with the rate of air flow according to a definite law, and when the rate of delivery of either nozzle is plotted against the air flow or the inlet-manifold vacuum, a smooth curve is obtained. However, the richness of the mixture formed naturally depends on the deliveries of the two nozzles combined. When this is plotted against the inlet-manifold vacuum or the car speed, it usually shows a certain irregularity in the curve where the delivery of the main nozzle begins to predominate over that of the idling nozzle, which results in a so-called "flat spot" in the engine-output curve.

Another objection to the formation of a combustible mixture outside the engine cylinders is that it results in a slight reduction of the volumetric efficiency, or in the mass of air taken in by the cylinders under certain operating conditions. Of course, even if the fuel were fully vaporized before entering the cylinders it would occupy only about 2.5 per cent of the space occupied by the air, and if it is only partly vaporized its relative volume will be less. But in order to avoid

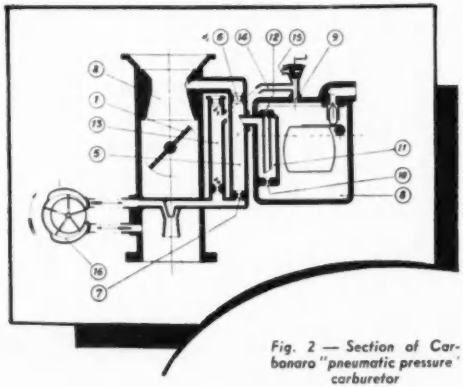

Fig. 2 — Section of Carbonaro "pneumatic pressure" carburetor

Mixture Preparation

By P. M. Heldt

distribution difficulties it is necessary to maintain the entering charge at a fairly high temperature, and any increase of the temperature will decrease the volumetric efficiency and hence the specific output of the engine.

Almost anything which can be done to overcome the deficiencies thus enumerated increases the complexity and the cost of the equipment required to form the combustible mixture, and it is therefore only natural that efforts to improve the methods of mixture formation have been largely confined to the field of aircraft engines, where outputs and total rates of fuel consumption increased rapidly during the recent war. Some modern aircraft engines consume fuel—and expensive high-octaine fuel at that—at a rate in excess of 200 gph, and in the case of such engines a considerable extra expenditure on mixture-forming equipment is warranted if it results in even a moderate increase in the thermal efficiency.

The field of new techniques in mixture formation was reviewed in a paper presented by M. M. Carbonaro before the French Society of Automobile Engineers (SIA) and published in a special number of the SIA Journal issued on the occasion of the Paris Automobile Show. Some of the items of equipment described in the paper are of American origin and already known to readers of AUTOMOTIVE INDUSTRIES Following is a transcription (not a word-for-word translation) of that part of the paper which deals predominantly with European conditions and developments in this field. It is rather unfortunate that although most of the illustrations are provided with numerous reference letters, a key to these letters is missing in the original publication. But while it is thus impossible to give a full technical description wth the aid of these reference letters, the original features of each device upon which its mode of operation depends are sufficiently evident from the drawings.

M. Carbonaro point out that whereas in the U. S. automobile engineers are seeking to increase the fuel economy of engines by resorting to the use of higher compression ratios, this solution is less applicable in Europe, because European engineers have to contend with fuels derived from Mid-Eastern crudes, which, because of their high sulfur contents, do not lend themselves so well to the production of high-octane motor fuels as do American crudes.

In the aircraft field there are serious objections to the constant-level (float-chamber type) of carburetor because, where high rates of consumption are involved the float chamber must be quite bulky and, besides, the action of the float is affected by inclinations to the horizontal and by accelerations, which latter are very high in aerial maneuvers or acrobatics. In engines with a high speed range the metering function of the carburetor also leaves a good deal to be desired. Between idling at, say, 500 rpm and full-load operation at 4000 rpm the rate of air flow through the carburetor will vary in the ratio of 1:16. This corresponds to a variation of the suction force—on which the metering function depends—in the ratio of 1:256, from which it may be concluded that under the low-

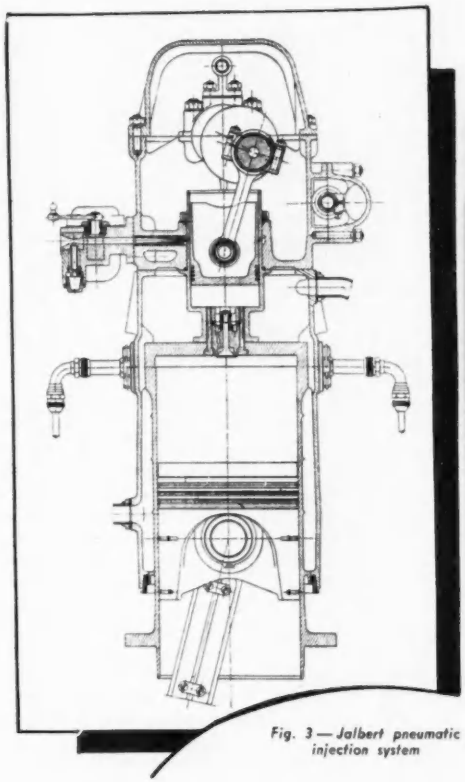

Fig. 3 — Jalbert pneumatic injection system

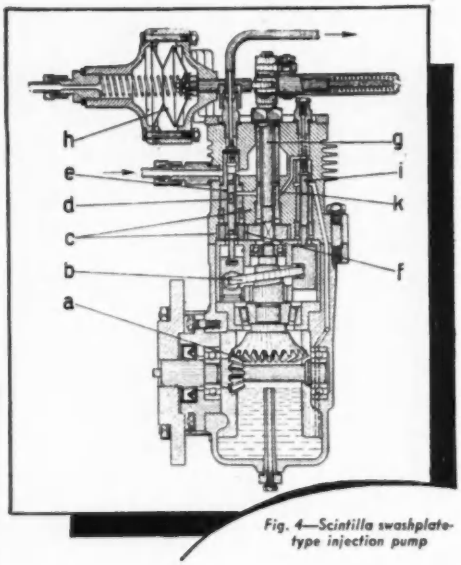

Fig. 4—Scintilla swashplate-type injection pump

output conditions the metering cannot be very accurate.

The presence of the throttle disk in the inlet passage leads to fuel precipitation, and the resulting heterogeneity of the mixture in the manifold, combined with the coarseness of the spray under low suction forces, is largely responsible for inequalities in the distribution to the different cylinders. There are also a number of other disadvantages inherent in the system by which a combustible mixture is formed outside the engine. One of these is the existence, in advance of the flame front in the cylinder during the period of combustion, of a combustible mixture capable of instantaneous ignition or ignition *en masse*, which results in detonation. This limits the maximum useful compression ratio to about 7.5, as compared to the 14 to 15 used in Diesel engines, and this in turn limits the maximum thermal efficiency to 24-26 per cent, as compared with 33-35 per cent for the Diesel. It can thus be seen that the "simplicity" of the conventional-carburetor system is paid for with a great waste of fuel.

The considerable length of time the fuel is mixed with air previous to ignition results in the formation of peroxides, which tend to aggravate the phenomenon of detonation. Another disadvantage of the system is the high specific consumption at low loads, due to throttling of the gases. If we calculate the efficiency of the Otto cycle for different values of the ratio P_i/P_a, where P_i represents the inlet-manifold and P_a the atmospheric pressure, we obtain the following table:

P_i/P_a	1.0	0.8	0.6	0.5	0.45	0.4
Efficiency	0.383	0.372	0.317	0.243	0.166	0.07

If the change in output were obtained by merely changing the richness of the mixture, with constant air admission as in a Diesel engine, the theoretical thermal efficiency would be constant at all outputs, because it would depend only on the compression ratio.

Engines supplied with a "pre-formed" mixture therefore have a number of fundamental defects, resulting from the use of a butterfly valve to control the mixture supply and from the impossibility of operating on very lean mixtures because the range of ignitable mixture ratios is quite limited. As the number of cylinders increases the problem of uniform distribution becomes more difficult, and the cylinder number, of course, bears a relation to the power output. Then there is the danger of backfires into the inlet manifold, which is filled with combustible mixture. This hazard is aggravated in supercharged engines, due to precompression of the charge in the manifold and the increase of the manifold contents with the number of cylinders.

To overcome these disadvantages recourse has been had during the past several years to a number of new systems which may be classed under four different headings. The first group comprises

(a) Injector carburetors without float chamber but with a venturi and with spray formation under pressure in the inlet pipe beyond (or downstream from) the throttle (Bendix-Stromberg);

(b) Injector carburetors without float chamber and without venturi, with spray formation under pressure beyond the throttle (Hobson);

(c) Carburetors with spray formation under pneumatic pressure beyond the throttle (Carbonaro), and

(d) Carburetors with spray under gas pressure di-

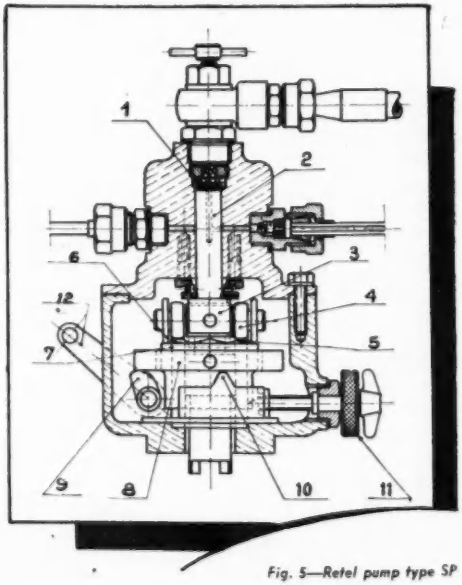

Fig. 5—Retel pump type SP

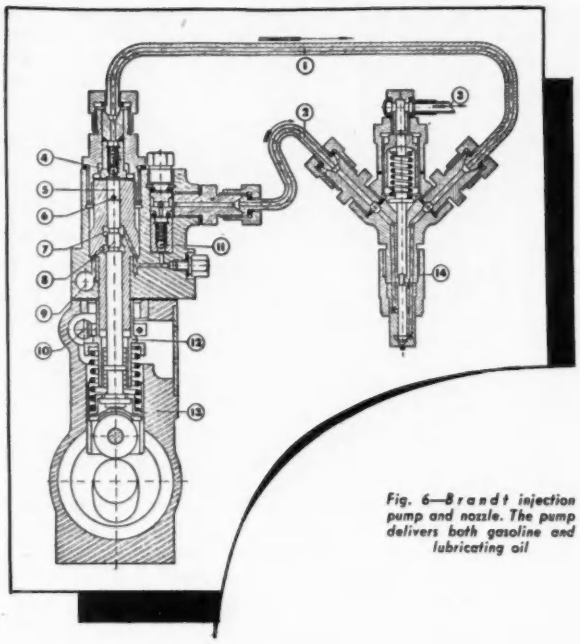

Fig. 6—Brandt injection pump and nozzle. The pump delivers both gasoline and lubricating oil

rectly into the cylinders (Jalbert).

These devices are essentially conventional carburetors which have been improved by providing them with novel metering and spraying means. They comprise a fuel-metering orifice subjected to a pressure difference which is a function of the rate of air flow; an intake manifold for the distribution of the preformed mixture, and a throttle valve for the control of engine power.

A second group includes

(a) Continuous mechanical fuel injection into the inlet manifold (Scintilla) and

(b) Periodic mechanical injection into the inlet-valve domes (Brandt).

These may be referred to as external-injection systems, and they have in common the features of fuel metering by means of a pump with variable effective stroke, the latter a function of the inlet-manifold pressure; and control of power output by means of a throttle valve located at the entrance to the inlet manifold.

A third group comprises

(a) Direct injection of fuel into the engine cylinders by a pump having a variable effective stroke depending on the inlet-manifold pressure (Brandt, Junkers, Deckel, Bendix, Retel, Lavalette), and

(b) Direct injection into the cylinders by a constant-pressure pump and a distributor connected to the inlet throttle (Retel).

These may be referred to as direct-injection systems characterized by direct injection of fuel into the cylinders by a metering pump, and by control of the power output by means of a throttle valve at the entrance to the inlet manifold. The manifold contains only air.

A fourth group comprises systems providing a constant charge of variable richness, on which work has been done by C.L.M., Barber, Retel, Starr and Bohetto-Fiat. With this system the inlet pressure is constant under all load conditions, full charges of air always being drawn in, and the output is controlled in the same way as in Diesel engines by varying the fuel charge per unit of piston displacement.

The Bendix-Stromberg injector carburetor, which was used on the majority of all American aircraft engines in the recent war, is familiar to readers of AUTOMOTIVE INDUSTRIES having an interest in this subject, and need not be described in detail. It may be stated, however, that in this unit the fuel is sprayed under moderate pressure (from 28 to 42 psi) into the inlet pipe beyond the throttle, by means of a spray nozzle which itself is supplied by a fuel pump of the continuous-delivery type, driven from the engine. Interposed between the pump and the nozzle is a metering device consisting of a balanced valve controlling the pump delivery, a diaphragm subjected to the pressure difference across the fuel-metering orifice, and a second diaphragm subjected to the pressure difference between the entrance to the venturi and the throat thereof. The fuel-metering valve and the two diaphragms are rigidly connected, and the valve always assumes that position for which the pressures on the two diaphragms are in balance. This arrangement assures automatic mixture control. The spray nozzle comprises a conical valve which is held to its seat by a spring and opened by the pressure of the fuel on a diaphragm to which the valve is secured. When the engine is shut down the valve closes automatically.

Among the advantages of this carburetor are the elimination of a float chamber, which reduces the bulk of the apparatus; and of fire risks in the event of a back fire into the inlet manifold; prevention of condensation on the throttle valve and of carburetor icing, and improved atomization due to spraying under pressure.

Hobson Injector Carburetor

The Hobson injector carburetor, like the Bendix Stromberg, has no float chamber, and in it the fuel is atomized in the inlet manifold beyond the throttle valve by a spraying injector supplied by a vane pump. A schematic diagram of the device is shown in Fig. 1. Its originality resides in the complete elimination of the venturi. For a given inlet pressure the rate of air flow is proportional to the speed of the engine. The fuel delivery is made proportional to the engine speed by means of a centrifugal pump whose impeller is secured to the same shaft as the rotor of the vane pump. Rotation of the impeller of the centrifugal pump engenders a pressure difference between the axis and the

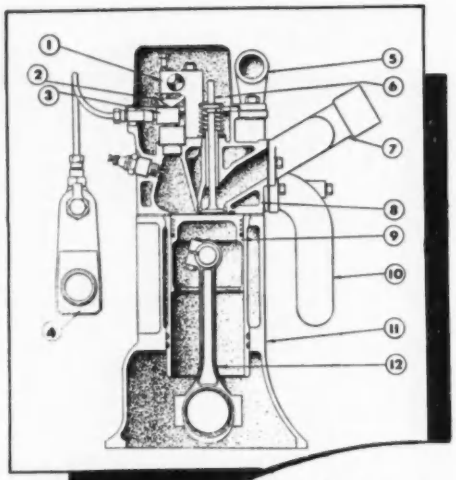

Fig. 7—Starr engine operating with fuel injection and a stratified charge

circumference proportional to the square of the engine speed. This pressure difference is reproduced across the fuel-metering orifice by a diaphragm actuating a balanced valve. The latter therefore delivers fuel in direct proportion to the engine speed, and automatic action is assured. To the advantages possessed by the Stromberg there is added an increase in the volumetric efficiency, since there is no venturi to throttle the air flow.

Carbonaro Carburetor with Forced Spray

M. Carbonaro, author of the paper here under review, was impressed with the undeniable advantages of direct injection, and it occurred to him that it must be possible to so improve the conventional carburetor that the following features would be combined: Fuel delivery in direct proportion to air flow at all loads, obtained by a single metering device, thus eliminating the superposition of a number of delivery rates and consequent "flat spots"; introduction of the fuel into the air stream beyond the throttle valve, and forced atomization by a current of air whose velocity always would be in excess of 450 fps (the threshold of true atomization), this air velocity being obtained without materially restricting the air passage. These ideas were embodied in a system of "pneumatic-pressure carburation" which was described in a paper presented to the First International Automobile Congress held in Paris in 1947, and which is shown in diagram in Fig. 2.

An ordinary spray nozzle, supplied by a float chamber and provided with the usual means to ensure constant-mixture proportions, instead of discharging into the venturi, discharges into a bypass extending from the neck of the venturi to a mixing tube or tuyere in the inlet passage beyond the throttle valve. This tuyere, in the form of an ejector, is supplied with air by a blower which draws its air from and delivers it to points in the inlet passage beyond the throttle. If the orifices through which the bypass communicates with the venturi and with the tuyere are suitably dimensioned, the depression in the bypass will be substantially the same as that at the throat of the venturi, hence the metering orifice will deliver in direct proportion to the air flow. However, the fuel is ejected from the tuyere at great velocity, hence it is finely divided, besides which condensation on the throttle disk is prevented. Since the blower draws air from the inlet passage beyond the throttle and also delivers it there, it has no effect on the rate of flow through the venturi, and automatic mixture control is ensured. Improvements in engine operation result from better distribution of the mixture to the different cylinders and from a material reduction in detonation with lean mixtures.

Jalbert Carburetor with Direct Air Spray into Cylinder

In this system (Fig. 3) each engine cylinder is provided with an auxiliary cylinder of much smaller displacement, communicating with the main cylinder through a narrow passage, closed by an automatic valve. Inlet ports drilled in the wall of the auxiliary cylinder communicate with a small carburetor of conventional design, which delivers all of the fuel necessary for the main cylinder.

The piston of the auxiliary cylinder is reciprocated by an eccentric shaft at one half crankshaft speed, and when it is at the bottom of its stroke there is very little clearance in the cylinder. During its up-stroke the piston creates a partial vacuum, and on approaching the end of this stroke it uncovers the inlet ports. The auxiliary cylinder then draws in a very rich mixture from the carburetor. During the down-stroke of the piston this mixture is compressed, and when its pressure exceeds that in the main cylinder, the automatic valve opens. The mixture is then injected into the main cylinder, where it becomes diluted with the air therein, which is being compressed at the same time. It is claimed that flow of the mixture past the automatic valve results in very fine division of the fuel. Distribution difficulties are obviated because each cylinder is independent of the others, and supplied by its own auxiliary cylinder. Special means are provided to ensure that the masses of air drawn in by the main and the auxiliary cylinder are proportional. As the fuel delivery in the auxiliary carburetor is proportional to the air passing through that carburetor, automatic control is assured.

In practice the accelerator pedal acts on the throttle of the auxiliary carburetors through a single linkage, and the vacuum existing in the carburetor beyond the throttle is automatically reproduced in the inlet pipe of the main cylinder by means of a "pneumatic slave."

The Jalbert equipment makes possible cold starting and correct carburetion under all conditions of load with liquid fuels having a high latent heat, such as alcohol. Moreover the high degree of atomization produced strongly forces back the threshold of detonation.

All of the devices so far described are related to the

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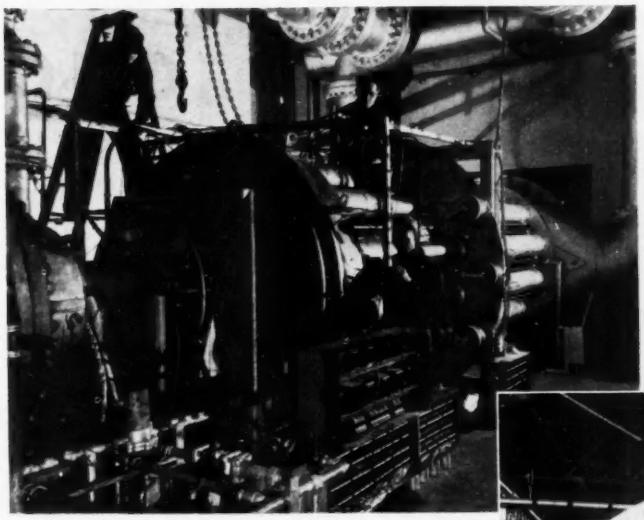
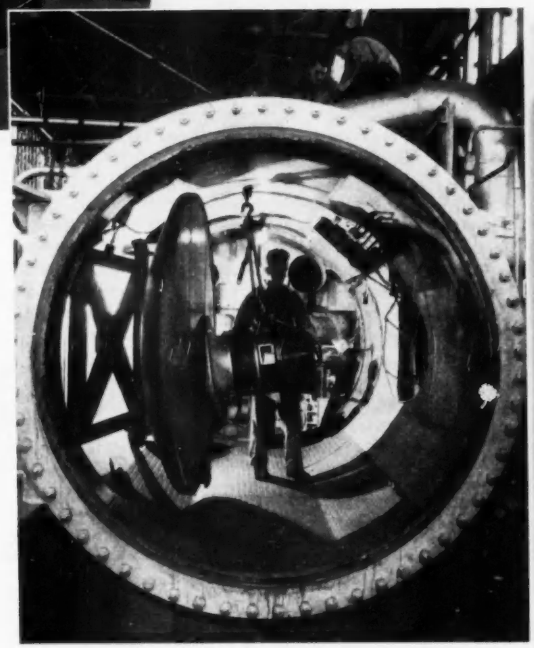


(Left) Turbine test stand at G.E.'s new jet laboratory in Lynn, Mass.

(Below) A scale model jet engine compressor being installed prior to testing.



Extensive Facilities Required for Developing Aircraft Gas Turbines

By E. E. Stoeckly,
Aircraft Gas Turbine Divisions,
General Electric Co.

LIKE any other complicated machine, an aircraft gas turbine can only be as efficient as the capabilities of its components. Unlike most devices, however, which can usually be put through a large scale development program, the gas turbine was an urgently needed war item. Much basic developmental work had to be by-passed and the best available model put into production.

Since the war, however, the completion of new test, development, and production facilities, so extensive that with previous ones they constitute a virtual "jet center," are making it possible not only to develop and test much better engines and components, but also to produce them faster. In the three years since the war's end, General Electric has invested nearly $11 million in these facilities at its Lynn River Works. Combined with Government-owned facilities, now leased by the company, and those financed by the company at the outset of the jet-propulsion program, they make the jet center the most extensive of its kind. Among the new facilities provided is one of the largest and most complete component testing laboratories in operation at the present time.

As the net output of a jet propulsion gas turbine is a minor percentage of the compressor-turbine shaft power, small improvements in the performance of either of these major components result in major changes of net output. Thus it is extremely important that the greatest attention be paid to minor details which affect major component efficiencies.

The selection of the sizes, power and airflows for the new facilities was dictated by a number of different factors. Most important of these was the steam supply available for the driving turbine, readily available power driving turbines, desirability of testing production components versus scale models, scale size factors, cost and time of building scale model parts as against

(*Turn to page* 58, *please*)

1949

De Soto Custom four-door sedan. Rear doors are hinged at the center body pillar. Note the ventilator in the rear door window.

FOR 1949 Dodge Division, Chrysler Corp., will feature three lines of newly-styled passenger cars mounted on two wheelbases and in eleven body styles. Coronet and Meadowbrook models—on the 123½ in. wheelbase chassis—include three four-door sedans, a club coupe, a convertible, an 8-passenger sedan, and a station wagon. The 1948 wheelbase was 119½ in. The new line is the lower-priced Wayfarer model on a 115-in. wheelbase, on which will be mounted a two-door sedan, three-passenger coupe, and a roadster scheduled for later production. Although the bodies are smaller in overall width, length, and height, the front seats are six in. wider while rear seats are eight in. wider. The instrument panel has been moved forward four in. to increase interior length. Windshield area is increased 24 per cent and windshield wipers clean 44 per cent greater area.

Accenting modernity of styling and many improvements in mechanical detail, DeSoto is offering two lines of cars for 1949—DeLuxe and Custom models—on a wheelbase of 125½ in., an increase of four in. over 1948 models. Despite the large increase in wheelbase, overall length is somewhat less than before. Although bodies are smaller in overall width, length, and height, front seats are five in. wider while rear seats have been widened by eight in.

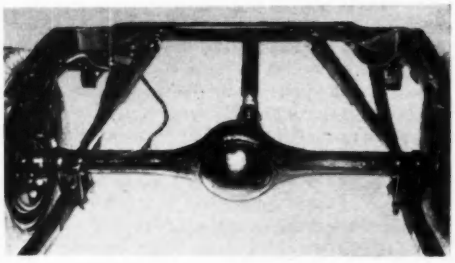
Body types on the two De Soto models are as follows: *DeLuxe*—four-door sedan, club coupe, Carry-All, and station wagon; *Custom*—four-door sedan, club coupe, convertible coupe, eight-passenger sedan, nine-passenger Suburban.

Although mechanical features remain about the same from the standpoint of specifications, a number of changes and improvements have been incorporated in the Dodge and DeSoto cars. First is the redistribution of weight incident to the rearward shift of the rear axle. Not only was this effected without increasing overall length but it has, in addition, the effect of cradling the passengers within the suspension system, thus improving riding comfort.

In addition to shifting the rear axle on its 123½ in. wheelbase models, Dodge has also moved the front suspension forward. Increasing the wheelbase by four in. permits accommodation of roomier bodies without increasing the overall length of Coronet and Meadowbrook models.

Second is the introduction of Cycle-Bonded brake linings, bringing with it the elimination of rivets, thus increasing effective brake area and lengthening the life of linings. Hand brake operation has been improved by the addition of a double-pawl ratchet.

The entire DeSoto steering geometry has been changed. While the steering wheel is in about the same position relative to the driver, its angle of inclination has been changed to lower the top edge of



Direct-acting rear shock absorbers are mounted on Dodge as shown to provide stability and improved riding characteristics. The same arrangement is used on De Soto.

Dodge and De Soto Cars

New Bodies, Advanced Styling and Many Mechanical Improvements Are Featured. Dodge Has Three Models on Two Wheelbases—115 in. and 123½ in. De Soto Wheelbase Increased to 125½ in.

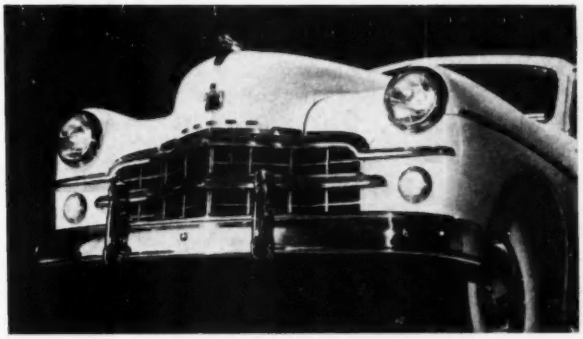
its rim by approximately 1 1/32 in. This was accomplished by moving the steering gear back a considerable distance and changing the linkage which now consists of a drag link from the pitman arm to a center idler arm at the front end, and from this arm equal-length tie rods to each front wheel. Caster angle is now two degrees negative and toe-in is zero.

The fluid drive transmission which has been used by De Soto for a number of years remains the same so far as driver function is concerned but now includes a number of changes designed to simplify the mechanism and make for smoother operation without necessitating a major change in gear box design and manufacture. The first of these is a complete redesign of the main hydraulic pump. Up to now it has been a self-contained element driven by gears off the mainshaft. In the new design the pump—still of gerotor type—is mounted concentrically with the mainshaft, the inner element being keyed to the shaft. Because of its larger diameter, the pump has been made narrower and more compact, since its capacity is ample for the job.

With the rearward shift of the rear axle, DeSoto engineers decided upon maintaining the same length propeller shaft. Consequently, the transmission is fitted with a suitable extension which, at the same time, serves to house the relocated hydraulic pump.

The second basic change is a complete revision of the hydraulic control valves. Previously the unit had two spring loaded piston type valves, the main control valve being operated by an auxiliary electric solenoid operated relay valve. The new design features a single ball check type poppet valve operated by a direct acting

(*Turn to page* 51, *please*)



Dodge front end styling features a new chrome plated stainless steel grille with large rectangular openings. There is 5¾ in. more space between the headlamps which are located 3¼ in. higher than on the 1948 Dodge. Improvements in the headlamps include a bull's-eye lens in the center of the sealed beam lens and a new bulb with a shorter focal length of the filament.

The Dodge Coronet presents a low silhouette with graceful body and fender lines.

Design Features of the

World's Largest

By L. M. Ballard

Chief Engineer,
Fruehauf Trailer Co.
of California

and Ellis W. Templin

Automotive Engineer,
Los Angeles Department
of Water & Power

Specifications of Tractor, Trailer Adaptor and Trailer

Tractor

Make	Peterbilt Motors Co.
Model	355 DT
Gross rating	56,000 lb
Wheelbase	205 in.
Cab to axle dimension	118⅛ in.
Frame, size	3½ in. by 10⅜ in. by 9/32 ¼ in. insert
Engine	Hall Scott Model 400 1090 cu in.
Air brakes	Westinghouse
Main transmission	Fuller Model 10B920
Main transmission speeds	10 (2 ranges)
Auxiliary transmission	Spicer Brown-Lipe Mod. 8031C
Front axle	Timken 27454-W
Rear axle	Timken SD 462W
Gear ratio	8.15-1
Capacity	44,000 lb
Tires	11.00 x 22-12 ply
Steering gear	Ross T 71
Overall gear ratios	
Low low	180.5 to 1
Direct	8.15 to 1
High high	3.87 to 1

Low Bed Trailer Adaptor (Jeep)

Make	Fruehauf Trailer Co.
Model	D50 S
Weight complete	15,000 lb estimate
Pay load capacity	55 tons
Frame	High tensile steel 50,000 psi yield stressed under 25,000 psi
Bogie	Four axles in tandem by pairs
Tires	10.00 x 15-20-ply platform trailer type
Wheels	Budd disk
Axles capacity each	30,000 lb
Brakes	Westinghouse 6-in. cylinders

Low Bed Trailer

Make	Fruehauf Trailer Co.
Model	CPT 100
Weight complete	22,000 lb estimate
Pay load capacity	220,000 lb
Frame	SAE 8645 normalized stressed 27,600 psi—yield point 81,380 psi
Bogie	Four axles in tandem by pairs
Tires	10.00 x 15-20-ply platform trailer type
Wheels	Budd disk
Axles capacity each	30,000 lb
Body	Fir; 3¾ in thick by 11 ft 6 in. wide, 17 ft long
Brakes	Westinghouse 6 in cylinders

WHAT is believed to be the world's largest highway transportation unit, built by the Fruehauf Trailer Co. of California and the Peterbilt Motors Co., was placed in service recently by the Los Angeles Department of Water and Power. It was developed as a means to carry out the Department's power system work in the movement of extra heavy generating machinery, construction equipment and electric transformers.

The largest single pieces anticipated to be transported were Hoover power receiving transformers weighing up to 217,000 lb each, which, with cribbing, estimated at 3000 lb, dictated a maximum pay load capacity of 220,000 lb (approximately 300,000 lb gross capacity). Other specifications of the unit are given in the table.

Special Design Features

The "backbone" of the main trailer, the rearward unit, consists of three 14 in. "H" steel beams of 95 lb per ft each, reinforced with 1 in. by 12 in. plates of SAE 8645 steel top and bottom.

The Fruehauf Trailer Co. engineers selected the curved beam formula as developed by Shanley in his book on *"Basic Structures"* as the formula to use in the design of the critical portion of the trailer frame at the "gooseneck." This formula dictated the one in. by 12 in. steel plate reinforcements of the "H" beams and at least a six in. radius at the riser whereas at this point a square corner is usually employed.

Additional precautions against excessive compressive stresses were taken by installing struts to distribute the compression forces at that point to the lower flanges of the "H" beams.

Acceptance Tests

After completion of construction and delivery of the unit it was inspected thoroughly and in the process was given a number of light jobs to do in which its performance was observed and found satisfactory. Following this period of preliminary trials, plans were made to make a full capacity load test of the unit.

Highway Transportation Unit

Arrangements were made for use of steel ingots and billets for making the test. Such units of steel had the advantage of making it possible to apply and remove gradually increasing and diminishing load, and avoid any risk attendant upon using actual costly electrical equipment as loads. This further allowed taking readings at intervals of load increase or decrease.

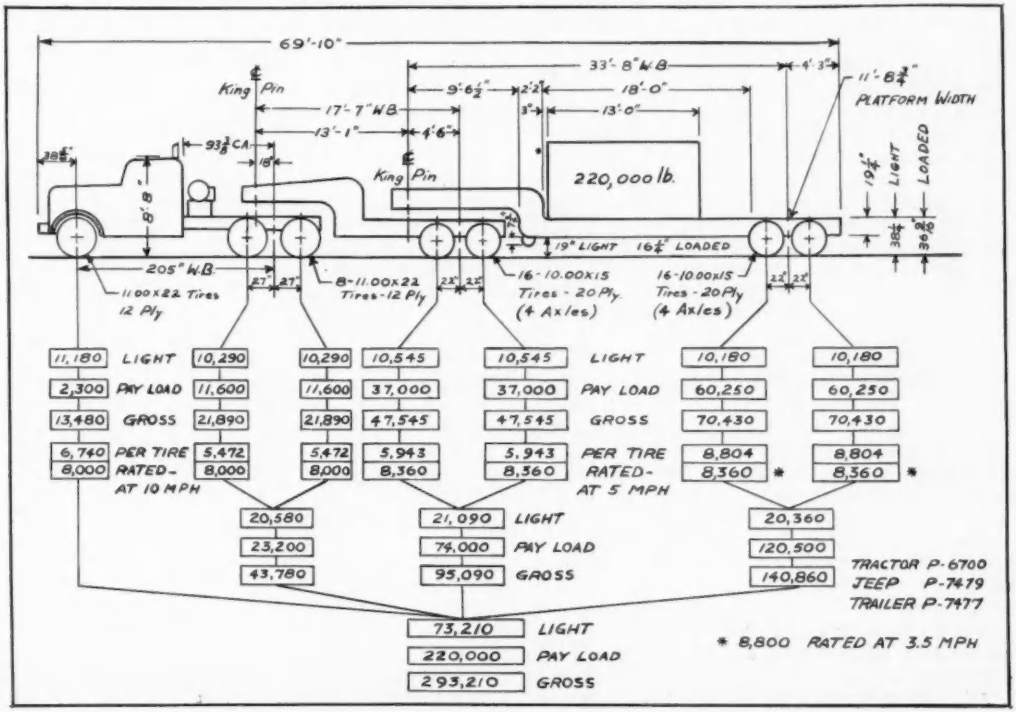
The main objective of the tests was to determine whether or not the structures would meet the key portion of the purchase specifications, namely "The frame shall be designed and constructed so that the unit stress in any frame member under maximum load shall not exceed 50 per cent of the elastic limit of the material."

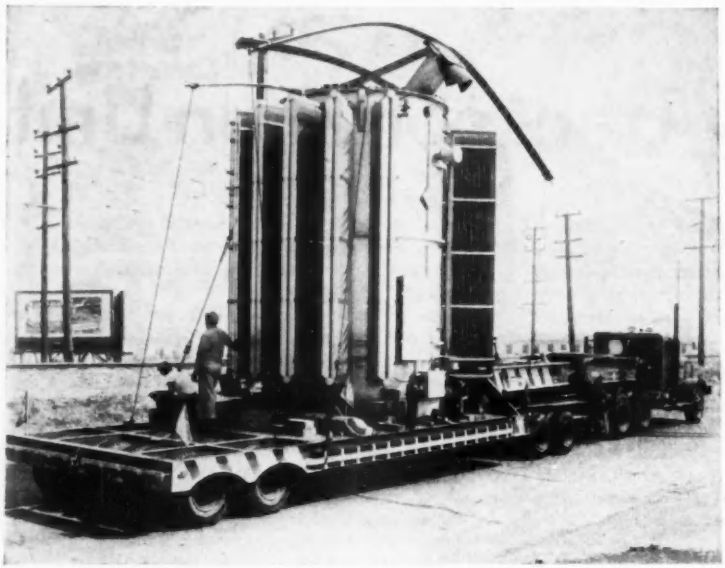
The general plan of the test was to apply the load gradually and by the use of Baldwin-Southwark strain gages, take readings at the various points of critical stress in the low bed trailer and located in the vicinity of the "goose-neck." This method of determining stresses was checked by taking readings of deflections. The readings of stresses were taken at this test under a load of 160,000 lb.

In the progress of the test, there was observed what appeared to be a wide difference in stressing with the trailer brakes on, and with the brakes off. For instance, strain gage readings indicated locked up stresses of high magnitude as against a calculated load stress of not to exceed 10,000 psi. This discrepancy has been unexplainable up to the present time, and only those figures taken with the brakes off are considered.

It was concluded from the data obtained that the design of the trailer would develop a maximum stress of 27,600 psi, and in order to comply with the specifications the material in the reinforcement plates must have an elastic limit of at least 55,200 psi, (two times the maximum stress). (*Next page, please*)

Load Distribution of 110-ton Semi-Trailer with Jeep Trailer





Here is the three-unit combination; trailer with a capacity of 110 tons, low bed trailer adapter (Jeep) which will carry 55 tons, and tractor which has a capacity of 22 tons.

During the progress of the initial loading tests, under a load of 168,000 lb, the reinforcement plate on the lower side of the left hand main beam of the trailer failed by breaking almost straight across.

An analysis brought out the facts that the metal was not in the annealed state as ordered from the steel supplier, had been flame cut, had a crack originating at a check in the edge as a result of the flame cutting, also that the hardness was 256 Brinnel, somewhat higher than should have been the case if the metal had been in the annealed state. The phenomenon of high compressive stresses with brakes set still confused the conference, leaving the impression that after any further work on the trailer, the whole structure should be stress relieved to remove any further doubt about the presence of residual stresses.

It was concluded that the steel used was of a good quality and that a piece of same dimensions should be reinstalled at the point where the break occurred, but by very careful welding.

The trailer was Magnafluxed and all cracks indicated at the edges mostly due to flame cutting were ground out. Weld defects discovered were repaired.

The trailer was then stripped and was stress relieved in a gas fired oven by bringing the temperature up to 1250F., holding it for six to seven hours and allowing approximately seven hours to cool in the oven.

A sample piece of the same kind of steel as used in the reinforcing plates was placed in the oven with the trailer where it received the same heat treatment as the trailer. A token of this sample was tested and showed an elastic limit of 81,380 psi, an ultimate tensile strength of 111,980 psi and an elongation of 30 per cent in two in.

This indicated that the steel was now in proper condition to do its work. The 81,380 psi elastic limit was considerably higher than the minimum required as stated above, namely 55,200 psi. However, it is necessary to consider that welds while not located at critical points, are near by. A conservative estimate of the weld strength is 80 per cent of the strength of the steel, which percentage applied to 81,380 gives 65,100 psi, which, in turn, represents a comfortable margin over and above the minimum allowable, namely 55,200 psi.

The trailer was reassembled and prepared for another test.

The general plan of the next test was to take readings of deflections at no load, half load and at full load as the load was applied to the low bed semitrailer unit.

Measurements as to deflection of members in the trailer structure were based upon surveyor's elevation readings at various points on the trailer.

The maximum deflection under the maximum load of 220,000 lb was found to be 1.38 in., a normal amount, at a point under the middle of the load.

During this test, observations did not disclose any abnormal deformations of the trailer even up to the full capacity load.

At this point it was felt that the unit was capable of carrying its load from a static standpoint. It was taken for a "spin," so to speak, to prove its ability to transport a capacity load on the road from a dynamic standpoint. The trip was taken on the surrounding streets. The unit was driven at 17 mph over railroad tracks and at a good speed, (possibly seven mph or twice the normal speed), on a right angle turn which involved a dip of approximately eight to 10 in. in depth. This operation all but dumped the load.

After this run the unit was brought back to the starting point and remeasured for deflection under full load, at half load, and finally for no load. With all loads removed, the frame of the trailer had come back to its original shape without any deformation and was considered structurally sound.

Actual weights of the unit less load (light) are

(*Turn to page 52, please*)

Steel Balls

Reduce Friction Between

Spring Leaves

Special machine that coats adhesive tape with shot.

By Herbert Chase

To reduce friction between leaves of transverse front springs, the Studebaker Corp. now employs steel balls in the form of hardened peening shot. They conform to SAE specifications P33 and average about 0.026 in. in diameter. These shot roll a short distance when springs are flexed and, as rolling friction is less than sliding friction, there is less resistance to spring action. Failure to keep the shot or the surfaces on which they bear well lubricated may result in some friction increase but this change is reported less than if no rolling action is provided.

Shot are sunk into the sticky surface of woven cotton fabric adhesive tape. This provides a convenient means of application of the shot to the tips of the spring leaves and holds the shot until it has rolled races for itself in the leaves. The springs remain unchanged, except for the inserts, and have the same oil-impregnated fabric and metal spring covers that have been standard equipment for several years.

Adhesive tape is coated with the shot in a machine designed for this purpose. The tape comes in rolls and is fed by a pair of rollers. In passing slowly through the machine, the tape moves along the bottom of a pan that is kept filled with shot from a hopper at the rear. Shot sticks to the coated surface, which is up, and this surface is thus substantially covered as the tape leaves the pan. There, a brush bearing against the shot removes any excess that may adhere and the tape continues through the pressure rolls. These force the shot into the adhesive and into the soft tape below it before the tape is rewound. It requires only two minutes and five seconds to coat a 36-yard roll of 2½-in. width.

Rolls of this Bauer & Black industrial tape coated with shot are then placed, six at a time, in the rack, from which six layers are fed to a Wolf fabric cutting machine whose reciprocating blade cuts the tape first into two-ft and then into two-in. lengths. These short lengths are passed to the spring assembly bench where a roller kept coated with a non-hardening No. 2 Permatex cement is used to coat an area near each end of the tension side of the four leaves of Champion springs

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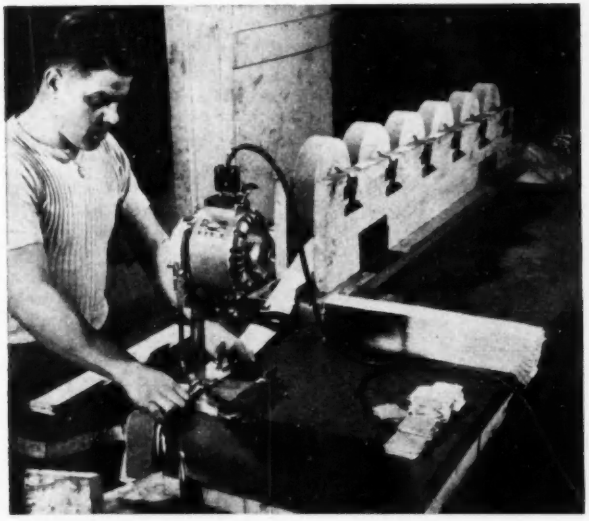


This Wolf fabric cutting machine cuts the shot-coated tape to two-in. lengths.

Oliver's Modernized Facilities

AN intensive drive to create advanced tractor building facilities spurred by its president, Alva W. Phelps, has borne fruit at the Charles City, Iowa, works of the Oliver Corp., where the line of wheeled tractors is produced. Apart from the introduction of improved methods and better housekeeping, the major results of the post-war program are found in a new final assembly building, and a modernized gray iron foundry—in the original foundry building—boasting specialized equipment of the latest type.

Final assembly employs the straight line technique associated with mass production lines of the automotive industries. At the same time the latest developments of the materials handling art have been employed to reduce manual handling, expedite smooth flow, and generally to reduce costs through increased productivity of the workers.

An important feature of the assembly building is the establishment of machine lines at one side, using machine tools of advanced type for machining the major parts of the tractor used directly in the final assembly.

Assembly operations start at one end with the rear frame casting installed on a dolly. At this stage the operators assemble the rear axle gearing, transmission gears, and add the rear axle extensions. Meanwhile the front frame assembly is prepared on another sub-assembly line. The two sections meet at a common junction, are fastened together permanently, the backbone sub-assembly then being lifted by an overhead hoist for transfer to the power driven final assembly line. The latter is a slat type flush-floor conveyor running some 522 ft.

Before the rear frame assembly leaves its sub-assembly line it moves over a final station fitted with an overhead mounted inspection fixture. Its function is to drive the gear train at given speeds to test for running quietness.

Final assembly is organized according to current practice in the automotive industries with sub-assembly stations off the line and directly at the point of application. The assembly conveyor is fitted with the familiar

View of the final assembly line with tractors in various stages of completion moving into the foreground.

for Producing Three Tractor Models

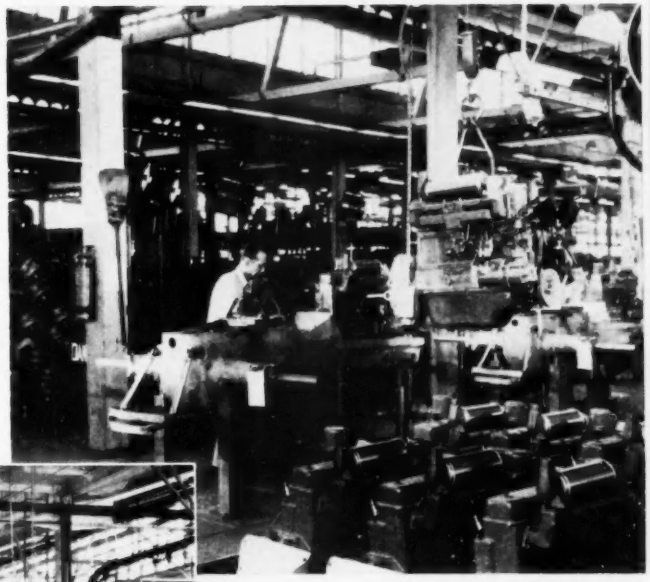
New Final Assembly Building and Rebuilt Gray Iron Foundry Now Have Specialized Equipment of Latest Type

By Joseph Geschelin

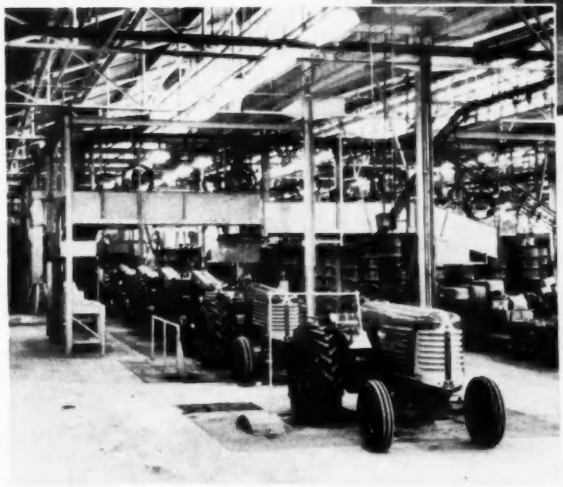
overhead Bull-Dog Trol-E-Duct power line from which are suspended the variety of high-cycle electric tools used by the operators.

Nearing the end of the assembly line, the tractors—still without wheels and tires—move through two large Despatch water curtain paint spray booths, then through a Despatch drying oven. At the exit end of the oven, operators mount the wheel and tire assemblies and install the front end sheet metal and hood. At the end of the line, the engine is started and the tractor is driven under its own power to a floor type wheel dynamometer where power delivered to the wheels is checked.

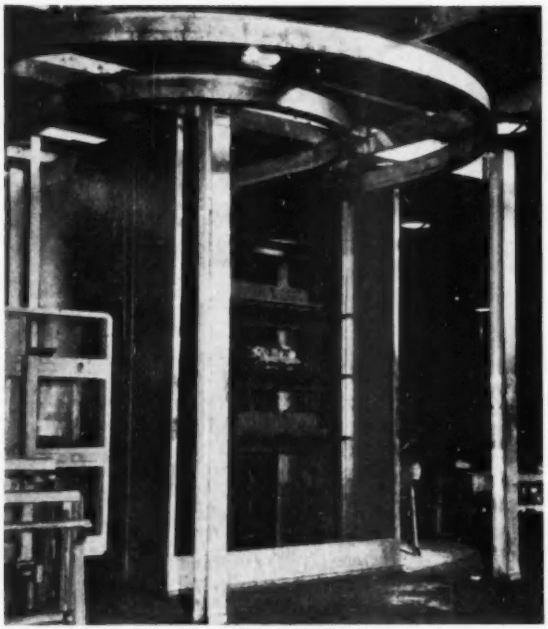
In addition to the final assembly line, the area near the terminal end also has a compact, conveyorized, paint system for washing and finishing sheet metal parts and wheels. Here they have two, 1000-ft monorail conveyors which carry sheet metal and wheels through Despatch continuous tunnel type, two-stage washing machines, paint spray booths, baking ovens,



One of the major operations on the line is installation of the engine. As shown here the engine is transported from the trim line at the right — out of view — and is handled by hoist for installation in the chassis.



End of the final assembly line at Charles City with tractors coming off the line in the foreground. The tractor at the extreme right is about to undergo the first final test on the dynamometer rolls. In the background may be seen the maze of monorail conveyors, the wheel conveyor through the paint shop being most prominent.



Here is a view of the large core oven with baked cores ready to be moved out. The detail of the heavy duty multiple-tray carrier for handling cores may be seen in this view.

and dry-off ovens. The wheels are handled separately on their own conveyor system, both systems in the paint shop being continuous and completely automatic in movement. The drying oven for the wheels is located above the tunnel type oven through which the tractors move.

The operation is rather interesting from the standpoint of scheduling. Charles City produces three basic tractor models in the new line and all of the component parts are produced over the same machine lines in the interest of reducing capital investment as well as compactness of floor space. Consequently, the basic models are scheduled in long economic runs, one model at a time. At any given time, therefore, the entire plant—machine shops, foundry, flow of purchased parts supply, and the final assembly line—is scheduled for a given model exclusively.

Changeover from one model to another requires a complete rescheduling of all activities—with due regard for differing lead times. To facilitate changeover on the assembly conveyor, they have designed the conveyor fixtures in such fashion that both front and rear supports remain unchanged but with the front support fastened flexibly on a bar with a series of drilled holes. A change in wheelbase from one model to another is effected simply by moving the front support to the proper location and fastening in place at that point.

To further the overall economy of the operation and to reduce the extent of changeover from one model to another, the company has been engaged for some time in a program of interchangeability. Wherever practical accessories and minor components are made interchangeable and the process is being extended still further as time goes on.

From the standpoint of materials handling the operation takes advantage of every device known to the art. Power driven assembly conveyors and monorail conveyors already have been mentioned. In addition, they use industrial trucks of various types, particularly in connection with palletizing, Oliver tractors, hoists, cranes, etc.

The duPont industrial color code has been adopted for interior paint treatment. To this end, they paint

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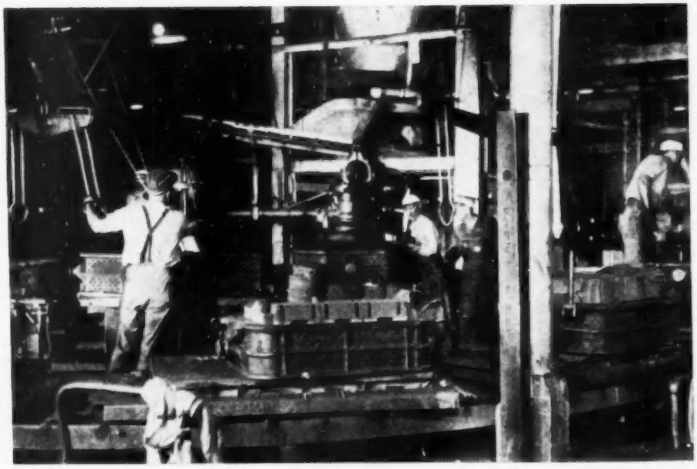


Close-up of one of the sand slinger stations in the new Oliver foundry. The four-station merry-go-round conveyor serving the sand slinger may be seen inside the outer power driven conveyor.

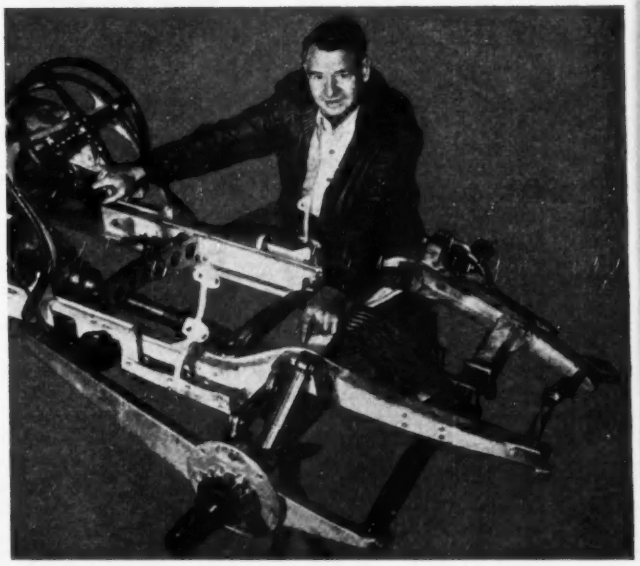
Blue Crown Special, Jr., Has New Engine and Rear Springing

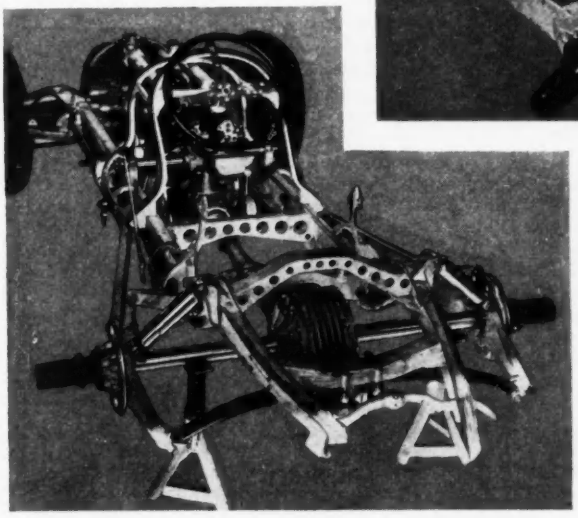
In addition to his two Blue Crown Spark Plug Specials, which finished one-two in each of the last two Indianapolis races, Lou Moore has entered a third car in the 500-mile classic on May 30. It is the Blue Crown Spark Plug Special, Jr., that was taken to Indianapolis in 1948, but was withdrawn prior to the race because it was found to be underpowered with a 220 cu in. engine. Originally the car was built for dirt track racing.

Incorporated in the 1949 car are two major changes — a higher-powered engine and a new rear suspension system, which is shown in the accompanying illustrations. For this year's race it has been equipped with a 270 cu in. non-supercharged Meyer & Drake four-cylinder engine.

To improve its handling characteristics, the former torsion bar suspension at the rear has been replaced by a transverse spring system, with the transverse spring supported by the cross member back of the quick-change rear axle. Two sets of shock-absorbers are used—friction and hydraulic types.

George Connors will drive the Blue Crown Spark Plug Special, Jr., at Indianapolis. Mauri Rose and Bill Holland again will be at the wheels of the other two racers.



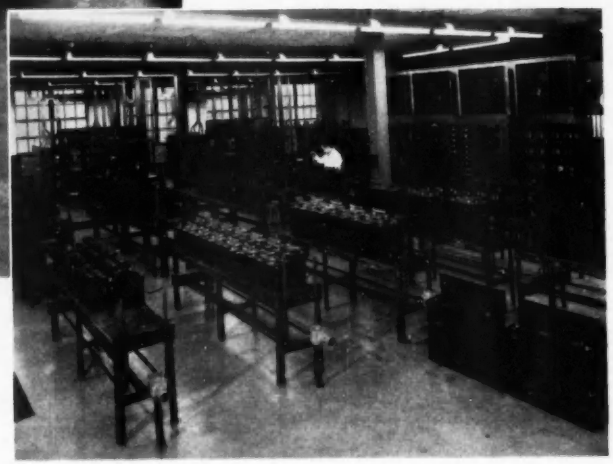


(Above) Lou Moore points to combination shock-absorber setup on new rear suspension system of Blue Crown Spark Plug Special, Jr., entered in this year's Indianapolis race.

(Left) View of Blue Crown Spark Plug Special, Jr., chassis showing details of rear transverse spring, its mounting, and torque rods.

At the left is a view of the pilot plant in the Gould laboratories. It is a complete experimental scale battery manufacturing facility where batteries of advanced design are built before releasing for production.

Experimental batteries built in the pilot plant are then routed to the test floor in the life test laboratory shown below. Special panel boards with automatic controls of cycling provide control of cycling and floating schedules, charging and discharging at various rates and loads.



Gould's New Laboratories

FUNDAMENTAL research, the basic tool for the advancement of progress in the automotive industries, is being applied on a major scale to the study and development of lead type storage batteries in the new laboratories placed in operation by the Gould Storage Battery Corp., at Depew, N. Y.

Storage battery research is complex in nature, involving metallurgical, chemical and electrical theory. Rubber, wood, plastics, glass and metals are all subjected to scrutiny.

Aside from the details of equipment and the extensive facilities assigned to this program, the fact of real interest to automotive engineers is that considerable thought and time and effort are being expended in studying storage batteries to determine the basic mechanism of their operation, to find ways and means of improving their design and characteristics, and to uncover ways of making them better. One of the first steps in this program is to increase the efficiency of utilization of active materials. Any practical improvement in this direction can lead into one or two main channels—either smaller and lighter packages of the same capacity; or increased performance from the same sized package. It appears feasible too to expect relatively small and light batteries capable of an enormous increase in performance where cost is unimportant.

Among the many avenues of approach followed in the laboratories is the scientific study of the cause and correction of positive grid corrosion. It now appears possible to create grids not only easier to handle in production but possessing much greater durability and longevity.

The lead oxides, better known as active materials of the positive plates, have been a constant subject of research since the building of the first storage battery. The elaborate testing equipment now available is making it possible to detect infinitesimal, but important traces of impurities. As a result, greater purity, and thus longer service is predicted from active material in the future.

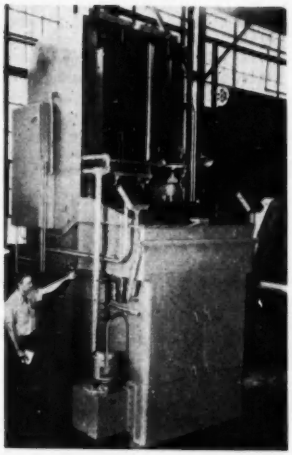
The separator is another of the basic elements being studied. The laboratories are investigating different kinds of wood separators, improved rubber separators with special treatments which promise improved life and effectiveness.

Needless to say, the laboratories are as much concerned with manufacturing techniques as with design and materials. Housed in a section of the new building is a complete pilot plant for the manufacture of experimental batteries. Here are tested the new designs to determine their suitability for mass production. The pilot plant is equipped with the latest types of process machinery used in the battery business, includes equipment of an advanced type as it becomes available. The work of this department naturally

(*Turn to page* 48, *please*)

B-39—Duplex Surface Broaching Machine

Recently completed by the American Broach & Machine Co., Ann Arbor, Mich., is a duplex surface broaching machine claimed the largest ever built. This massive unit, which broaches large



American Broach and Machine Co.'s large duplex surface broaching machine

diesel bearing supports, is over 15 ft in height and weighs in excess of 34 tons.

A feature of the tooling design is the automatic cycle of the left hand table and right hand broach arbor, both of which index six times in generating one complete broaching cycle. The left hand station surface broaches the step joint faces in the six passes, and the right hand station rough broaches the half round surface in six passes.

The part broached weighs over 150 lb, approximately ½ in. of stock being removed on approximately 110 sq in. of surface. A chip conveyor handles the excessive amount of chips accumulated in broaching a part this size.

The 72 in. stroke, 40 ton capacity machine is equipped with interlocked

NEW Production and Plant EQUIPMENT

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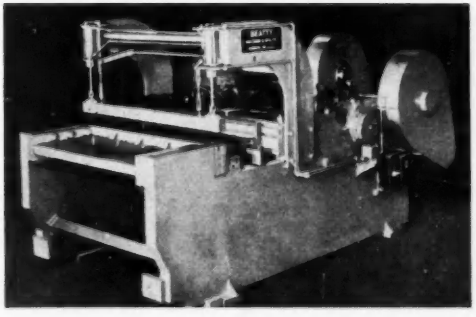
electrical controls and provides continuous machine cycle during the six passes necessary to complete one part. The production of this part has been increased by twenty times through the adaption of broaching over that obtained from the previous machining method, the company states.

B-40—Horizontal Multiple Punch

A horizontal multiple punch is introduced by the Beatty Machine & Mfg. Co., Hammond, Ind., designed for multiple punching the flanges of long, wide sheets, and allowing for punch tools to be mounted on varying centers across the ram face. The machine is fitted with an air clamp device which holds the material down during the punching operation for gauging purposes. Stripping is accomplished by air cylinders which travel with the ram. The frames are of welded steel plate. Clutches are of the jaw type with motor drive V-belt to flywheel.

The new machine is available in capacities from 50 to 300 tons. Specifications on the 200 ton machine illustrated consist of a distance between housings of 63 in.; a stroke of 6 in.; stroke per minute, 28 in.

The die space (ram back), is 18¼ in.; ram width (vertically), is 10¾ in.; ram length (right to left), 72 in.; table width vertically, 9 in.; table length, right to left, 72 in.; and depth of throat, 6 in.



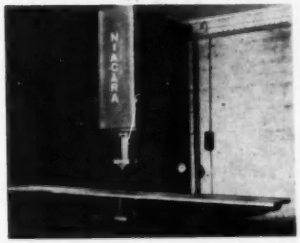
Beatty horizontal multiple punch, capacity 200 tons.

B-41—Hydraulic Metal Working Press

Straightening, forming, broaching, forging and assembling operations are all handled by the new hydraulic metal working press announced by Niagara Machine & Tool Works, Buffalo, N. Y.

With the Niagara hydro-touch control, approach speed, applied pressure of the ram, and return speed are governed by the movement of one lever conveniently located to give sensitive finger tip control. This enables the operator to feel his way into a job, and gives a smooth fast operating cycle.

Speed of ram approach is proportional to initial movement of the lever. Hence the operator may approach the



Niagara multiple purpose hydraulic press

job at maximum speed and slowly advance the ram onto the work. When the punch first touches the work the pressure exerted is practically nil. Further movement of the control lever applies pressure on the work in proportion to the amount of lever movement, up to the capacity of the press. This feature is said to be of particular importance in straightening operations since just the right amount of pressure may be applied to remove the distortion.

Releasing the lever at any point stops the ram, the lever automatically returning to neutral position. Raising the lever to extreme upward position lifts the ram to top position.

The frame, bed and table are one piece welded, machined as a single unit to precision limits. Area of bed is 30 in. by 240 in. Maximum capacity of 135 tons can be exerted at any point in the 33 in. of ram travel.

B-42—Vertical Honing Machine

A model B7 vertical honing machine has been added to the line of honing machines manufactured by the Staple Engineering Co., Birmingham, Mich.

The machine is hydraulically operated and electrically controlled and is adaptable to work having inside diameters from ½ in. to 4 in. inclusive; up to 6 in. in length. Timing cycle is adjustable from 3 to 180 seconds, with standard equipment. Size control is manual by graduated dial.

NEW Production and Plant EQUIPMENT

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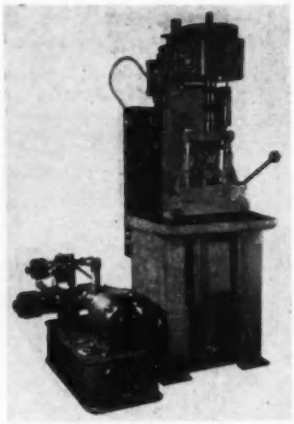
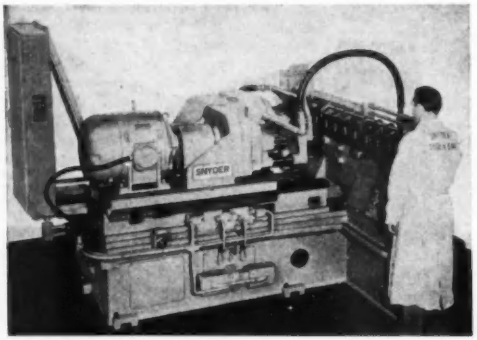


Model B7 honing machine of the Staple Engineering Co.

The reciprocating work table is 6 in. wide by 18 in. long and has 8 in. travel.

A variable speed drive is provided for the honing spindle. Honing stones are fed out and contracted automatically. Pressure and rate of feed are adjustable. The machine is supplied complete with all electrical controls, self-contained hydraulic unit, coolant pump and tank.

B-43—Drilling and Tapping Machine



Snyder drilling, counter-sinking and tapping machine for processing automotive upper control arm assemblies

A drilling, counter-sinking and tapping machine which reduces the work cycle to 16 seconds on processing automotive upper control arm assemblies and cuts floor space to 25 per cent of former requirements has been designed and built by Snyder Tool & Engineering Co., E. Lafayette, Detroit, Mich.

The machine has one loading and two work stations. When four parts are loaded into the guide rails, against the rest plate, the automatic work cycle is started and parts are automatically shuttled into the drilling station.

A bushing plate equipped with locating pins and spring-loaded buttons is advanced and locates and clamps the parts as the machining cycle starts. The sixteen spindle drill head, using high speed steel drills, is equipped with heat treated alloy spindles mounted in ball bearings and with standard, adjustable drill adaptors. Stroke is 10 in.; feed 0.009; speed 60 S.F.P.M. Drills are changed by dropping the bushing plate.

When the drilling and counter-sinking cycle is completed, parts are automatically shuttled to the tapping station and located and clamped in position by a hydraulic pressure plate equipped with locating pins and spring-loaded buttons. The tapping unit is a solidly mounted, sixteen spindle, individually lead screw type tapping head with heat treated alloy steel spindles. Tapping speed is 40 S.F.P.M. Taps are staggered to reduce the power load. Each work cycle completes 16 7/16-20 holes.

Indexing mechanism is a three station, hydraulically actuated transfer bar. While drilling and tapping operations are being completed, the shuttle mechanism returns to the starting position. Parts are automatically unloaded at the rear of the machine.

Drilling head is powered by a 20 hp motor and the tapping head by a 10 hp motor. A work cycle of 16 seconds produces 788 pieces per hour at 87½ per cent efficiency. Work cycle is synchronized to an electrical interlock safety system. Floor space is 88 in. by 107 in.

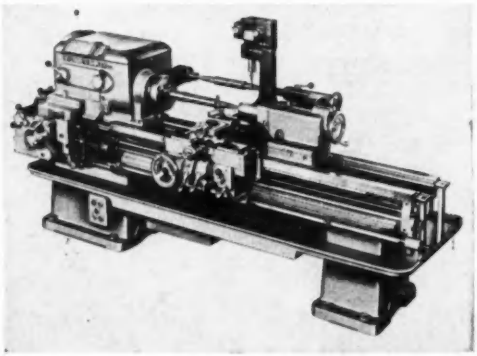
B-44—Tracer-Controlled Dual-Purpose Lathe

Just announced by the Lodge & Shipley Co., Cincinnati, Ohio, is a new tracer-controlled dual-purpose lathe, known as the "Copymatic." The machine embodies an all-hydraulic tracer control in the company's standard Model "X" 16-in., 20-in. medium and heavy duty, and 25-in. medium duty, lathes.

Feature of the lathe is the facility with which the unit can be converted from standard lathe operation to automatic duplication and vice versa. Changeover is instantaneous, accomplished by turning two valves and a switch.

On duplicating work, the tracer operates from round or flat templates on turning or boring jobs. Reproduction of multiple diameter shafts with square shoulder faces, grinding necks, tapers in both directions, chamfers and curved contours are performed. In many cases, need for a template is eliminated. The first piece of a lot can be machined by standard operation of the lathe; this piece is then used as a template for the production of the balance of the lot.

The swing capacity of the standard lathe is maintained because standard compound rest and cross feed screw assemblies are used and directly connected to the hydraulic piston operating within the cylinder mounted on the rear of the carriage. This feature and the fact that the machine may be used for either



Lodge & Shipley "Copymatic" tracer-controlled dual purpose lathe.

standard or duplicating work without limiting the range of either, removes the unit from the "special purpose machine" classification, according to the maker. There is nothing to take off or put on when changing from one type of operation to the other.

B-45—Universal Screw Stage

A new universal screw stage brought out by the Jones & Lamson Machine Co., Springfield, Mass., is said to check pitch diameter, lead and angle as rapidly as the pitch diameter alone can be checked with a snap gage.

NEW Production and Plant EQUIPMENT

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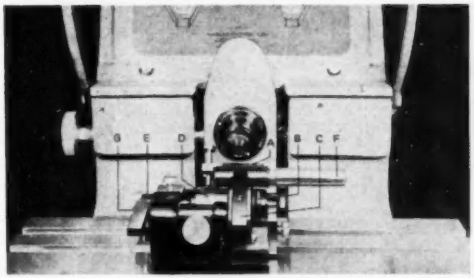


Jones & Lamson universal screw stage.

Its methods simultaneously compares all the elements of a production thread with a master gage. It checks at a glance, lead (for the whole length of engagement of the screw), pitch diameter and thread angle; crest, root and taper. Also an enlarged shadow instantly reveals wear of tools, chasers, rolling dies, or grinding wheel. It not only detects each individual error, but also shows the cumulative effect of error.

A pair of rolls, corresponding to the pitch of the thread to be inspected, is mounted on the roll shaft, the fixed roll being spaced longitudinally from the center of a lens, at a distance equal to the length of engagement of the screw to be inspected. A master gage is then staged on the rolls. It is also supported and held by an adjustable backstop "A" and a spring operated clamp "C."

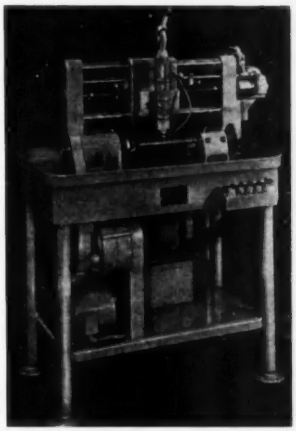
An enlarged shadow of the master thread is then made to coincide with the correct tolerance outline on a chart, thus representing a perfect screw in a perfect nut. The master gage is then replaced by the production screw to be inspected.

The shadow of the production screw thread must fall between the maximum and minimum tolerance outlines on the comparator chart, to pass inspection. The space between the outlines represents the permissible tolerance for the class of fit required. Lateral displacement of the shadow shows lead error; vertical displacement shows pitch diameter variations.

This staging fixture, with four pairs of rolls, accommodates any screw of a given form from 3/16 in. to 1 in. dia, and any pitch from 6 to 44, whether right hand or left hand.

B-46—Cylindrical Superfinisher

Gisholt Machine Co., Madison, Wis., announces addition of a general purpose cylindrical superfinisher to their line, designed to handle medium to small parts such as plug gages, hydraulic cylinders, pistons and shafts.



Gisholt general purpose cylindrical superfinisher, Model 50

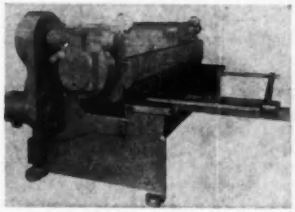
The machine, Model 50, has a capacity of 12 in. between centers, 8½ in. swing with a 3 in. maximum working dia, and a workpiece weight of 100 lb. It has variable spindle speeds from 40 to 1000 rpm to suit various diameters and degrees of finish. Longitudinal oscillation stroke is 3/32 in. at 600 complete cycles per minute. The quill is spring loaded and adjustable from 0 to 45 lb of pressure. The machine is equipped with an adjustable tailstock and a complete lubricant system.

Two standard machine attachments are available: The motor driven traverse attachment (as shown installed on the machine) and a centerless roll drive attachment which is available for parts that have no centers.

B-47—Squaring Shears For Mild Steel

A new series steel squaring shears, are available from Columbia Machinery and Engineering Corp., Hamilton, Ohio, in seven sizes for shearing ⅜ in. to 1¼ in. mild steel in six and ten foot lengths. Three additional models for high-speed precision shearing of 3/16 in. mild steel, 10 and 12 ft long, and ¼ in. by 6 ft. incorporate all the important design features of other new series models except a motor-driven back-gauge and hydraulic holddowns.

All new series steel squaring shears are provided with a new vibration-free worm-gear drive. Shaft and worm are



Columbia steel squaring shears

machined in one piece from high-alloy chrome-nickel steel. Worm gear is aluminum bronze with tensile strength of 60,000 psi.

A high-carbon, alloy-steel clutch, with six jaws, is bolted to the web of the worm gear and operates on the squared end of the eccentric shaft, for rigid driving connection. The clutch is actuated by an electric solenoid, operated by a portable foot switch. The drive and clutch operate in an oil-tight, dustproof housing.

Automatic hydraulic hold-downs, cam-controlled, grip the work firmly before the blade begins to cut. The hold-downs consist of a series of independently-operated plungers, actuated by oil pressure. The same pressure is exerted by each plunger, regardless of travel, so that a uniform grip is applied throughout the entire length of long pieces,

preventing slippage, even when narrow strips are sheared.

A motorized back-gauge is operated by an individual electric motor and controlled by a push-button switch. Adjustment is made through a simplified chain and sprocket drive and screw and is self-locking. A vernier dial indicates exact setting. The eccentric shaft is heat-treated, high-carbon steel with eccentrics forged integrally, for rigidity and positive alignment. Blades of special-analysis shear-blade steel are standard equipment.

NEW Production and Plant EQUIPMENT

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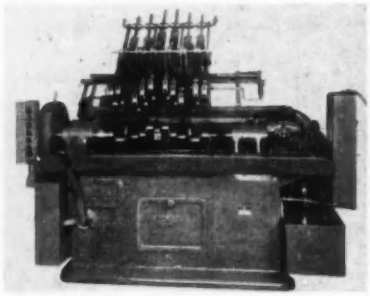
B-48—Machine For Rolling Crankshaft Fillets



Method of rolling fillets of crankshafts on Schraner machine.

(Left) Front view with crank shaft ready to be unloaded.

(Right) Closeup of one pair of rolling shoes showing varying width of roller periphery.

A. P. Schraner & Co., Cleveland, Ohio, make available a new method for rolling the fillets of crankshafts as developed in General Motors Corp. and adapted to the heavy duty Schraner crankshaft lapping machine. The application permits rolling all fillets of main and pin bearings simultaneously.

In place of the regular crankshaft bearing lapping shoes, this machine is equipped with shoes of special design, one pair of shoes to encircle each pin and main bearing on the crankshaft. Each pair of shoes is fitted with four formed, steel rollers, suitable for rolling the fillets under pressure as the crankshaft is rotated.

The rollers, two in each half of each pair of shoes, are oppositely mounted at 45 deg angles to the lines of the crankshaft bearings and side walls, with approximately 1/16 in. clearance between faces of the roller hubs and the housing of the shoe which supports them.

The extreme periphery of the rollers is formed from a flat, the width of which, theoretically, as the roller turns one revolution, starts from a given point at zero, and increases in width to approximately 3/32 in. or whatever dimension the radius of the fillet to be rolled requires; and then decreases to zero again.

Between and adjacent to the periphery and the side walls of the rollers, are ground 45 deg angle surfaces which, when in operation, parallel on one side the horizontal line of the crankshaft bearing, and on the other side, parallel the perpendicular line of the side walls.

The corners, or edges, adjoining the periphery and the 45 deg. angle adjacent thereto, are ground to a radius of approximately the same dimension as the radius of the fillet to be rolled.

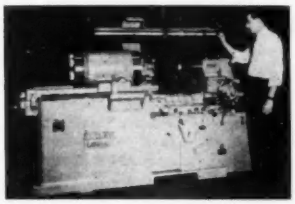
This form of tool allows the rolling action to bear against the fillet surfaces, as the crankshaft is rotated, with an ironing and burnishing action. Since the relation of the diameters of the rollers and the diameters of the surfaces on which they work, are varied with respect to each other, each point of the roller surface applies a different condition to each point of fillet surface throughout the operation, and the entire fillet surface is rolled completely and uniformly.

Pressures used for this operation are from three to five hundred pounds.

B-49—Double Chuck Workhead

The illustration demonstrates the size of work which can be chucked on the 112-M internal grinder offered by the Bryant Chucking Grinder Co., Springfield, Vt. The machine is designed to grind special internal tapers on such parts as machine tool spindles and special axles. A sine bar attachment provides accurate taper control. I.D., O.D., and face can be ground at one chucking. An attachment (not shown) allows the workpiece to be indexed 180 deg so that concentricity is assured when both ends of the piece are to be finished.

The workhead moves longitudinally to position the work for grinding. For large O.D. work the workhead is moved to the left end of the machine and a steadyrest is used to support the end



Bryant double chuck workhead on No. 112-M internal grinder

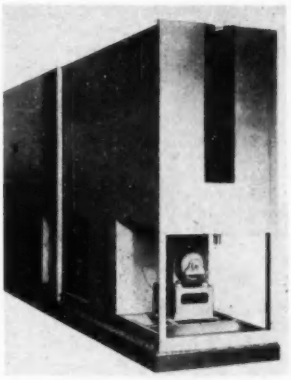
to be finished. The workhead can be removed and replaced by a fixture so that spindles can be ground while rotating on their own bearings. The workhead base is of the swiveling type, providing for grinding a maximum included angle of 30 deg.

Wheelhead assembly is moved hydraulically to the rear of the machine to facilitate loading of long pieces.

B-50—Spotless Dryer For Metal Parts

A new mechanical dryer for the spotless drying of metal parts after plating or polishing and before subsequent plating or lacquering, is announced by Optimus Equipment Co., Matawan, N. J. Originally designed to meet the needs of the plating industry for drying highly polished metal surfaces without water spots, stains or streaking, the new dryers have been adopted for all types of metal parts handled by racks or monorail on a continuous production basis.

High velocity jet nozzles, directional and adjustable, employ combinations of cold and hot air drying. The cold blast



Optimus spotless dryer for metal parts.

NEW ★ PRODUCTS

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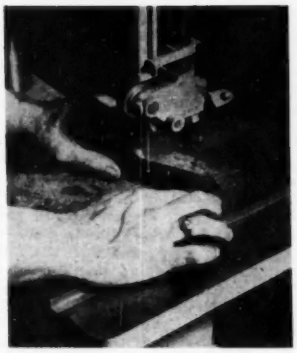
C-41—Spiral Blade Band Saw



Tyler band saw with spiral blade

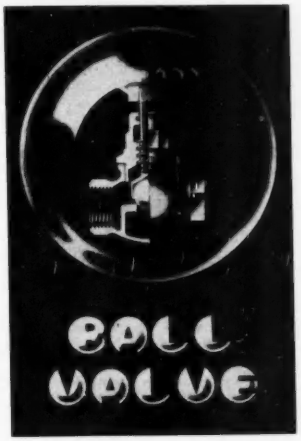
Intricate cuts are said to be made cleanly and easily in such widely different materials as steel, plastic, and foam rubber with the new Tyler power band saw with spiral blade, a product of Tyler Mfg. Co., Los Angeles, Calif. Claimed to cut any line that can be drawn, the performance of the saw is made possible by its spiral blade and its planetary transmission. Presenting a 360 deg cutting edge, the blade cuts in any direction. The infinite speeds planetary transmission provides a saw speed range of from 70 ft per minute (for steel and other tough metals) to 5000 ft per minute (for wood, aluminum, and other light materials). Rubber-tired guide rollers hold the blade to a rigid cutting line.

Because this spiral blade saw cuts freely in any direction the operator can cut any pattern without turning the work. He can saw to the center of any material 24 in. wide and of infinite lengths, and can work from either right or left side of the band saw. The operator even can accidentally touch the moving blade with his hand or fingers without injury, according to the manufacturer, since the spiral blade has no saw tooth edge.

The band saw cuts steel, iron, wood, lpastics, bronze, aluminum, wire, plywood, leather, tin, linoleum, bamboo, felt, bakelite, nails, masonite, glass, cardboard, and screening. An automatic adjustment dial sets the proper speed for each of the materials. A hardened Tyler blade (81 Rockwell hardness) is recommended when the saw is cutting metal. The regular tempered spring steel blade is used for wood and other soft materials. A combination guide permits use of either Tyler spiral blade or conventional flat blades.

Specifications on the Tyler band saw are 60 in. high, 12 in. throat, 8½ in. clearance under guide, table tilt: 45 deg right, 5 deg left, 4 in. blade tension adjustment, and 1/3 horsepower heavy duty 110-volt electric motor.

C-42—Precision-Seating Ball Valve



"Bull-Dog" ball valve of the Carpenter Mfg. Corp.

"Bull-Dog" valve, presented by the Carpenter Mfg. Corp., Cleveland, Ohio, contains a precision ground stainless steel ball in place of discs, poppets, etc., its principles being claimed to afford a life-time seating member having harmless effect upon the seat. This departure from former valve practices is also claimed to give improved flow characteristics as a result of the shape of the ball.

The ball is spun into its retainer allowing a slight clearance so that the ball may spin when the valve is opened or closed. This permits the ball to find a new seat each time. Ball clearance is held accurately to prevent chatter when opening, closing or throttling.

The ball valve is supplied with "O" ring seals, for normal service where high temperature is not involved. Conventional steam packing is used in valves installed in steam or other high temperature service. These ball valves are available in ½ in. and ¾ in. pipe sizes, in brass.

C-43—Capacitor-Type Pressure Indicator

Photocon capacitor-type pressure indicator, "Dyna-Gage"

An improved design of a capacitor-type pressure indicator named "Dyna-Gage," and associated electrical equipment have been developed by Photocon Research Products, Pasadena, Calif., for measuring static and dynamic pressures in internal combustion engines, gun chambers, hydraulic devices and other applications requiring pressure measurements under actual operating conditions.

The mechanical design of the capacitor-type indicator consists of four principal parts: water-cooled frame and diaphragm (machined from a solid piece of invar steel), insulated fixed plate and electrode assembly, coil assembly, electrode shield and a cable connector. The rigid diaphragm has a very high natural frequency and is insensitive to shock and vibration. No mechanical linkage is required between the pressure diaphragm and the electrically-sensitive element.

The unit's electrical components consist of an oscillator-detector that provides relatively high voltage output with a flat frequency response from 0 to 10,000 cycles per second, and a voltage-regulated power supply. Cathode ray or galvanometer oscillographs usually are employed for viewing or recording pressures.

Photocon points out that the principle of the condenser indicator and its associated equipment is not limited to pressure measurements alone. In the automotive field, for example, the technique and equipment can be used to measure stress and strain, flywheel deflection, cylinder head and block deflection and to obtain valve-lift diagrams. It can also be used in aircraft propeller shaft balancing machines. In other fields the unit can be used to measure or indicate unbalance in high-speed rotating machinery, vibration, and other applications.

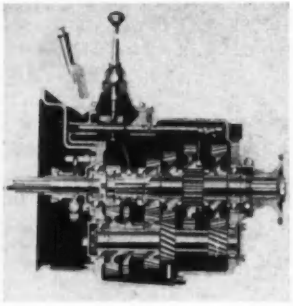
NEW ★ PRODUCTS

For additional information regarding any of these items, please use coupon on page 47.

C-44—Four-Speed Transmission

With the recent introduction of its new Model 4-A-112 four speed transmission, the Fuller Manufacturing Co., Kalamazoo, Mich., now offers a complete series of four, five, and ten-speed transmission for use with engines of up to 1120 cu in. displacement.

This newest Fuller transmission is designed for both on and off-highway applications where a high percentage of operation through gears in conjunction with auxiliaries is required. It is especially applicable to earth-moving machinery and has been adopted as standard equipment on models produced by



Four-speed Fuller transmission, Model 4-A-112

the LaPlant-Choate Manufacturing Co., Inc., and the Woolridge Manufacturing Co.

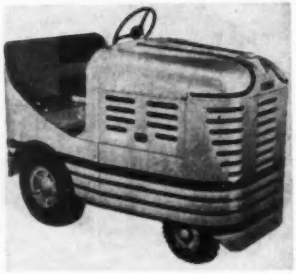
Model 4-A-112 is based on the design features of Fuller's extra heavy-duty Model 5-A-1120. High capacity in the new model is provided by helical gearing in all four forward speeds. The helical gears, engaged by sliding jaw clutches, permit easy shifting.

In combination with a three-speed auxiliary transmission, Model 4-A-112 provides 12 forward and three reverse speeds. When used with a two-speed auxiliary, eight forward and two reverse speeds are obtainable. The model also offers a wide range of ratios, with optional second and reverse speeds.

C-45—Redesigned Towing Tractor

Full protection for tires on the wheels is provided by the new steering axle now standard on the redesigned Clarkat industrial towing tractor, according to announcement of the Industrial Truck Division, Clark Equipment Co., Battle Creek, Mich.

Steering tread of the new axle has been reduced from 27 in. to 22 5/16 in. which permits wheels to be turned to their extreme position within the body of the machine. Wheel wells around the tires have been reduced in dimension to provide further tire protection.



Redesigned Clarkat towing tractor.

On the new axle, the steering tie rods have been raised and a heavy steel plate 6 in. wide is mounted beneath the axle to protect the steering mechanism. The plate is attached to the axle support back of the axle and to the tractor body in front by removable bolts. A universal joint incorporated in the steering mechanism helps eliminate wheel kickback.

The new Clarkat is equipped with Innacush-type solid tires on all wheels, pneumatic and solid tires optional for rear drive wheels only. A new upholstered air-cushioned seat is standard equipment.

C-46—Electric Controlled Air Powered Valve

Bellows electrically controlled air powered valve

A new solenoid-actuated air control valve, in ¼ in. and ⅜ in. port sizes, which uses the air it controls to operate the valve, and operates at a speed over 2200 per minute, is a product of the Bellows Co., Akron, Ohio.

The new valve consists of a cast bronze body incorporating a single air inlet, electrical terminals, and a cylinder in which floats a light weight piston. The piston engages and shifts a four-way shear-flow air valve. The caps enclosing each end of the cylinder hold small eight volt solenoids. Solenoid plungers, operating through only 1/32 in. of movement, release the full pressure of the air supply line to drive the light weight piston and shift the four-way shear-flow valve in the desired direction. The valve operates on five to 150 lbs air line pressure. A special transformer reduces normal 110 volt primary voltage to the required 8. Valves are adapted to direct connection or to remote control of any standard air cylinder.

C-47—Electronic Welding Control

A single-phase to single-phase low frequency electronic welding control that has a lower kva demand and a higher power factor than the standard single-phase to single-phase control is available from Westinghouse Electric Corp., Pittsburgh, Pa. It makes possible welding of scaly or rusty steel with a minimum of spitting from the electrodes and also can be used for welding brass or aluminum.

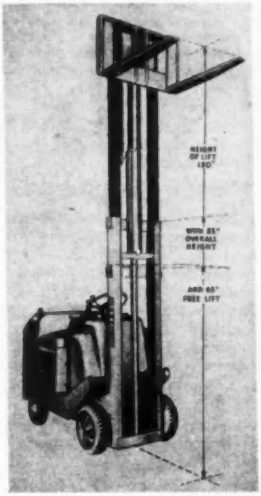
This control is a frequency converter which, by means of electronic tubes, converts current at line frequency to current at lower frequency. The complete unit consists of three basic components: (1) a sequence panel which coordinates electrical functions of the control with the mechanical functions of the welder; (2) a frequency control

Westinghouse single-phase to single-phase electronic control for resistance welding

circuit which transforms line frequency into a lower frequency; and (3) a weld timer which times duration of the welding current.

The control is designed for connection to a resistance welding machine having a specially constructed transformer with a center tapped primary. Operation of the control is such that current is passed in one direction through the primary for four half-cycles, stopped and then reversed for four-half-cycles thus producing a low frequency alternating current on the output side of the transformer. The electronic circuits accurately control the duration of each of these one-half cycles.

C-48—High Lift for Industrial Trucks



A new high free lift mast for Towmotor models LT-40, LT-44 and LT-48, developed by the Towmotor Corp., Cleveland, Ohio, consists of a total lift of 130 in., a free lift of 65 in., and a lowered mast height of 83 in. The new high free lift Towmotor also offers exceptional visibility while maintaining standard capacity ratings on three models—from 3000 to 5000 lbs.

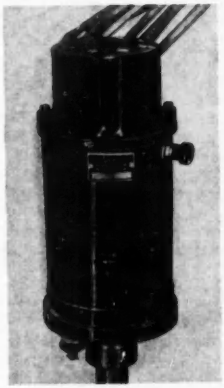
C-49—New Vertical Swiss Magneto

With a shank machined to fit sttandard distributor mountings, the "Vertex," a vertical magneto manufactured in Switzerland is now being imported and distributed in the U. S. by F. T. Griswold Mfg. Co. of Wayne, Pa. It is adaptable to engines of four to 12 cylinders designed for automobile, marine, industrial and aircraft use with special models for racing.

These magnetos are available for either right or left hand rotation. They are fitted with automatic advance to suit

NEW ★ PRODUCTS

For additional information regarding any of these items, please use coupon on page 47.



"Vertex" vertical magneto distributed by F. T. Griswold Mfg. Co.

engine characteristics and may be equipped for impulse starting under extreme conditions. They may also be fitted with engine speed governors.

C-50—Portable Spot Welding Torch

Developed by the Linde Air Products Co., Unit of Union Carbide and Carbon Corp., New York, N. Y., a portable inert-gas-shielded spot welding torch called the Heliarc HW-8, permits making spot welds from only one side of the work without backing the weld location or requiring forging pressure.

Mild steel, low alloy and stainless steel, 0.030 to 0.064 in. thick can all be welded using currents from 155 to 250 amp. Not only can two sheets of these metals be joined in one to two seconds per spot, but also a sheet of metal can be joined to underlying material of any thickness. This makes it possible to spot weld corrosion-resistant sheets to mild steel to provide cladding.

Argon gas shields the electrode and weld area to prevent oxidation. Welding duration and argon flow are controlled by a separate timer unit. The torch uses alternating or direct current with high frequency starting and stabilization of the arc.

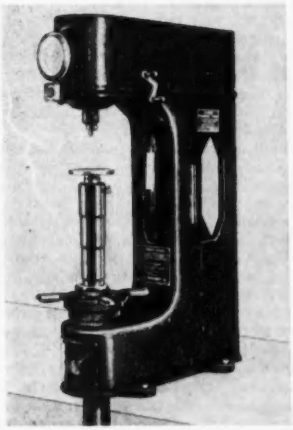
Only one hose assembly connects the torch to the accessory equipment. Standard hose assembly, 25 ft. long, is about an in. in diameter and contains conductors for power cable, cooling water, shielding gas, and trigger control.

Linde Heliarc HW-8 spot welding torch

C-51—Improved Hardness Tester

A new and improved Rockwell hardness tester offering ease and simplicity of servicing is announced by Clark Instrument, Inc., Dearborn, Mich. Identified as Clark hardness tester model C-8A, C-12A, and C-16A, the new instrument provides a spindle housing and beam assembly replaceable by the owner himself without special skill or special tools. The body of the tester is cast in aluminum, and weighs from 65 to 85 lb less than similar units made from steel or cast iron. A frictionless spindle assures correct minor load every time, according to the manufacturer. A positive tripping feature is said to overcome danger of an incorrect major load being caused by friction or drag of the tripping lever on the loading beam.

The tester is used for "Rockwell" testing of hard or soft steel, brass, aluminum, cast iron, copper, other metals.



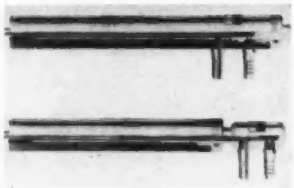
Clark Instrument Co. improved Rockwell hardness tester, offered in models C-8A, C-12A and C-16A.

C-52—Welding Electrode Holder

A new, leak-proof, water-cooled resistance welding electrode holder reported in production at P. R. Mallory & Co., Inc., Indianapolis, Ind., is being marketed under the name Mallory "KO Holders."

Elimination of the problem of drops of water which cause rust or discoloration of the material being processed has been accomplished by use of standard size O-Rings in place of ordinary packing.

Copper alloy, brass or stainless steel is used for the complete assembly, including all internal parts of the "KO Holders." This is said to insure full water flow for the life of the unit and to keep the tip ejector mechanism free from any rust or corrosion which might interfere with its easy, efficient action.



Mallory "KO" water-cooled resistance welding holder

Subjected to laboratory tests the ejector mechanism was operated more than 50,000 times under water pressures far greater than encountered in normal usage.

C-53—British Vibration Tester

A new instrument called a wave correlator capable of immediately determining the cause of objectionable vibrations in running shafts, gears, couplings, and rotors by attaching the instrument to the machinery when running, is announced by the Dept. of Scientific and Industrial Research, London, England.

First, high quality wave analyzers are used to measure the vibration component under investigation and to separate it out from the remaining components. The particular component is retained as an alternating electrical voltage. This voltage is then applied to the wave correlator instrument.

Into the wave correlator instrument are fed in addition, time-marking pulses derived from the rotation of the various shafts in the system, each shaft being caused to generate a small sharp electrical impulse at one fixed point in its rotation. The correlator then indicates directly whether the frequency of the noise component under investigation is an integral multiple of the speed of any shaft.

NEW ★ PRODUCTS

For additional information regarding any of these items, please use coupon on page 47.

C-54—Live Center For Lathes

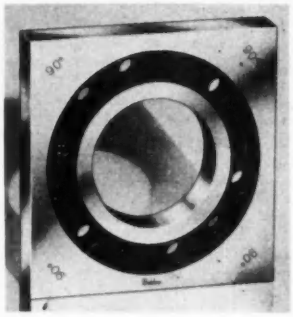
A precision ball bearing live center for lathes has been designed by the South Bend Lathe Works, South Bend, Ind., for strength and rigidity requirements of heavy roughing cuts, and for accuracy in fine work at high speeds. The revolving center is made from electric furnace tool steel, heat treated to a hardness of 61 to 65 Rockwell C. The center point shaft extends through the taper shank and is supported by bearings at both ends. A precision ball bearing carries both radial and thrust loads, and center point whip is eliminated by a rear pilot bearing. All parts are interchangeable and replaceable.

This live center is available in two sizes; the smaller having a No. 2 Morse taper shank and the larger a No. 3 Morse taper shank.

C55—Pneumatic Screwdriver

The Cleco Division of the Reed Roller Bit Co., Houston, Texas, announces production of a new reversible pneumatic screwdriver for driving No. 8 machine screws or equivalent. The driver is 5 7/16 in. long, weighs 9½ oz. and is 21/32nds of an in. at maximum dia. Impact mechanism gives a fast, powerful driving force without torque reaction. There is no hand throttle. When the bit is pressed on the work the valve opens automatically to drive the screw.

C-56—Indexing True-Square

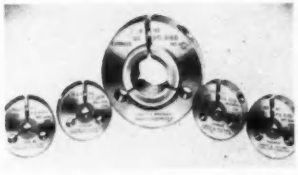


Designed primarily for precision indexing, a new "True Square," offered by the Webber Gage Co., Cleveland, Ohio, features all faces at precisely 90 deg. to adjacent sides, with perfect optical flatness and parallelism. Accurate to millionth parts of a circle, it may be combined with Webber angle gage blocks to index any desired combination of angles.

C-57—Carbide Thread Ring Gages

For long production runs of day in and day out accuracy, Pratt & Whitney, Division of Niles-Bement-Pond Co., West Hartford, Conn., are furnishing their new P&W go-and-not-go carbide Dualock adjustable thread ring gages. These gages eliminate the hazard of gage wear on close tolerance work, and serve as master or reference gages because of their long wearing qualities and stability.

These carbide Dualock adjustable thread ring gages are adjustable because they have the same AGD locking mechanism as steel rings. They are relieved at the major dia. to preclude possibility of interference, thus assuring required contact on the thread flanks but not on the crest or root. They are convoluted on both ends to remove partial threads up to the start of the full thread. And they are precision lapped to remove grinding marks and irregularities on the thread flanks. P&W precision lapping corrects variation in thread angle and produces a uniform smooth surface over the entire thread flank.



Pratt & Whitney go-and-not-go carbide Dualock adjustable thread ring gages

PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE INDUSTRIES. In making requests please be sure to give the NUMBER of the item concerning the publication desired, your name and address, company connection and title.

A-60—Floor Type Units

National Automatic Tool Co.—Way type units for drilling, boring, tapping and facing operations used in automatic processng are described and illustrated in a new 20-page catalog entitled, "NATCO Holesteel Model C Floor Type Units." Six case histories and actual production figures are included together with diagrams of single spindle, fixed center multi-spindle and adjustable multi-spindle heads. Spindle speeds and complete specifications of each available machine are also included.

A-61—Attachments for Lathes and Drill Presses

South Bend Lathe Works—New lathe attachment catalog No. 77-U. More than one hundred and thirty different attachments and accessories for South Bend lathes and drill presses are illustrated and priced in this new 28-page catalog. Many new items are cataloged, including some recently developed attachments not previously announced. Although these attachments and accessories are designed primarily for use on South Bend machine tools, many of them can be easily adapted to other makes.

A-62—Industrial Furnaces

Surface Combustion Corp.—An eight page folder describes and illustrates the company's line of standard-rated industrial furnaces. Equipment for a broad range of processes is presented, including hardening, tempering, forging, metal melting, air heating, etc. The folder provides a survey of what is available in standard equipment.

A-63—Industrial Trucks and Tractors

Crescent Truck Co.—A four page bulletin illustrates 20 different models of electric industrial trucks and tractors. It includes a questionnaire for determining the correct type and model of truck to use under various operating conditions.

A-64—Unified Screw Threads

Eastern Machine Screw Corp.—A new publication dealing with Unified Screw Threads and the new proposed American Standards Association publication B1.1 "Unified and American Screw Threads for screws, bolts, nuts and other threaded parts."

A-65—Selenium Rectifiers

Fansteel Metallurgical Corp.—A new comprehensive booklet on selenium rectifiers. Pointing out the limitations as well as the capabilities of selenium rectifiers, the book is designed to aid users of rectifiers to select, buy, and use them properly. Among the subjects discussed are: cell sizes and ratings, construction, protective coatings, forward and reverse resistance characteristics, grading of cells, efficiency, typical rectifier circuits, circuit formulae and constants, regulation, capacitance, aging, voltage doubler circuits, operation, temperature ranges, forced cooling, oil immersion, intermittent operation, and high voltage rectifiers.

A-66—Overhead Handling Equipment

Abell-Howe Co.—A 12-page catalog which illustrates and describes all types of the company's overhead handling equipment including cranes, jibs, monorails, and accessories.

A-67—Asphaltic Products

Witco Chemical Co.—A 40-page booklet, "Witcotes: Asphaltic Mastics," lists the wide variety of asphaltic products made by the company and gives their properties and uses. The booklet is divided into various sections covering automotive undercoatings, sand-filled and sandless deadeners, flame-proof deadeners, sealers, rust preventives, box coatings and asphaltic paints.

A-68—Production of Oil

Twin Disc Clutch Co.—The story of

TIME SAVER COUPON for your convenience in obtaining, WITHOUT OBLIGATION, more information on any one or more of the publications described above OR New Production and Plant Equipment OR New Products items described on other pages.

Readers' Service Department,
Automotive Industries,
Chestnut & 56th Sts., Philadelphia 39, Pa.

Please send me: **These FREE Publications** (Use letter and designating number of each item desired)	*Please send me more information on:* **New Production and Plant Equipment** (Use letter and designating number of each item desired)	*Please send me more information on:* **New Products** (Use letter and designating number of each item desired)
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Your Name ..... Your Title .....

Your Company Connection or Business .....

Address ..... (Street & No.) (City) (Zone) (State)

the production of oil—from the first survey to the refined product—is told in the Petroleum Issue of *Production Road*, magazine of the Twin Disc Clutch Co. Just off the press, this 28-page pictorial review of the oil industry contains sections devoted to the exploration, drilling, pumping, piping and refining of oil. Illustrated with action photographs of Twin Disc equipped machinery, it tells the complete story of oil and the part played by Twin Disc clutches and hydraulic drives in its production.

A-69—Stainless Steel Electrodes

Lincoln Electric Co.—Bulletin 463, "Stainless Steel Lincoln Electrodes," lists Lincoln's Stainweld and Chromeweld electrodes and discusses application, properties of welded metal and procedure. In addition it lists typical application for each type of welding rod.

A-70—Flexible Shafts

Elliott Manufacturing Co. — New catalog number 49. This 16-page edition describes and illustrates Elliott flexible shafts, flexible shaft machines, unit drives, attachments and push-ball controls.

A-71—Attachment for Palletless Materials Handling

Hyster Co.—A catalog bringing up-to-date the information on the Load-Grab, an attachment for palletless materials handling with Hyster's 2000 and 4000 lb capacity lift trucks. The eight-page brochure, illustrated with both model views and operational photographs, describes the hydraulically-controlled device which side squeezes bales, boxes, bundles, bags, barrels, drums, etc., with just enough pressure to lift without pallets.

A-72—Special Trailer Designs

Mercury Manufacturing Co.—A new 16-page catalog designated as Bulletin A-999, covering the company's special trailer designs. The catalog explains the economies possible with trailers, particularly when used in the Mercury "Trackless Train" system. Specific applications and uses of each type—caster, four wheel steer trailer and fifth wheel steer trailer—are also discussed. The second section describes and illustrates the various types of Mercury trailers that are available and includes detailed specifications for each. The third section of the catalog outlines the factors a prospective purchaser should look for and expect in an industrial trailer.

A-73—Metallizing Process and Uses

Metaweld, Inc. — Bulletin decribing metallizing process and uses, application and how it is used by industry for making mechanical repairs, and protecting surfaces against corrosion and contamination. Other industrial maintenance services are briefly outlined.

A-74—Compression Selection Chart

Worthington Pump and Machinery Corp.—A new selection chart, based on normal applications handling air with atmospheric intake pressure. The chart simplifies selection of proper size compressor for average industrial use, with quick comparison between discharge pressure psi gage and piston displacement cfm and shows recommended compressor bore and stroke in inches.

A-75—Punch Retainers

Wales-Strippit Corp. — A catalog which features the new Wales punch retainer that is designed to hold the punch in a self-contained holder and at the same time facilitates the removal of the punch by contracting the retainer spring.

A-76—Testing Machines

Tinius Olsen Testing Machine Co.—Bulletin No. 36 includes within its 36 pages all the physical testing equipment made by Olsen especially for the testing of plastics. There are sections on the Plastiversal, the Lo-Cap universal, the electronic recorders, the flow, torsion, load deformation, stiffness, torsion-stiffness, impact, heat distortion, creep and brittleness testers.

A-77—Electric Heat

Sta-Warm Electric Co.—Bulletin No. 0-40-W, discusses, in general terms, the Sta-Warm electrically heated melters, dispensers, and pouring equipment for wax and compounds.

A-78—Comparison Chart for Automatic Bar Machines

Cone Automatic Machine Co., Inc.—"Buyer's Comparison Chart for Multiple-Spindle Automatic Bar Machines." Provision is made for comparison and analysis of multiple-spindle automatic bar machine facilities. Buyers and users may easily grade all features of any brand in the order of their importance.

Gould's New Laboratories

(*Continued from page* 38)

integrates research with production since it provides the actual mechanism for determining the necessary changes and modifications in design to suit the manufacturing problem.

Apart from research in its pure sense the pilot plant has become a valuable adjunct to the production departments of the corporation since it is now possible to try out new designs and techniques before they are released for production. Too the pilot plant should prove of value in trouble-shooting in the event of some obscure difficulty resulting from changing field conditions.

One of the principal activities in the pilot plant is the study of improved methods of casting as well as the proof-testing of new casting techniques. This should pay dividends for the manufacturing operations.

Since lead is the chief material in the construction of automotive and industrial storage batteries made by the company and international conditions have made it relatively scarce, there is an intensive drive to find other materials by utilizing other good conductors where possible.

Since the storage battery is a chemical power plant in miniature, it is clear that chemical purity of the materials going into its construction is of vital importance. In fact, even though the purity of lead is held around 99.99 per cent, it must be free from minute traces of certain impurities, measured in thousandths of one per cent. To achieve such precision of analysis the laboratory boasts a modern, high intensity A.R.L.-Dietert spectrograph which is used for the examination of all metals. The resulting photographic film is examined by means of a Densitometer of the latest type capable of automatic vernier readings of traces to the thousandth part of one per cent. Spectrographic analysis of this character—used widely in various laboratories in the automotive industries—has eliminated wet chemistry methods here and yields quantitative results in a matter of minutes as compared with hours or days by conventional means.

Nor is the use of this equipment limited to research. Gould has found it profitable to sample every batch of lead and antimony and oxide that is used in production before releasing materials to the production department. In this respect the laboratory also serves as scientific receiving inspection.

Study of materials is furthered by use of an X-Ray diffraction machine for identifying complex metallic compounds and for analyzing their atomic structure. This is supplemented by a Riehle hydraulic tensile testing machine for mechanical testing; and instruments for metallographic examination and analysis of casting structure.

A relatively large area is devoted to the life testing of batteries of all kinds. Huge panel boards provided with automatic control of cycling and line floating operations provide any desired schedule of rates of charge and discharge of banks of batteries under test. This offers a means of accelerated testing with which battery life can be determined in a fraction of the normal service period. Too it makes possible the proof testing of new designs or improved methods of manufacture quickly and unmistakably.

PERSONALS

Recent Personnel Changes and Appointments at the Plants of the Automotive and Aviation Manufacturers and Their Suppliers.

Ford Motor Co.—**William Clay Ford** will join the company early this month. His first assignment will be in the sales and advertising department.

Timken Roller Bearing Co.—**Seward T. Salvage**, assistant district manager of industrial bearing sales in the Cleveland office, has been made sales promotion manager of the company. **T. F. Rose**, Cincinnati branch manager of the company's Service Sales division, has become manager of Timken Roller Bearing Service and Sales Limited, Toronto, Ontario, Canadian subsidiary of the Canton, Ohio, company.

Waukesha Motor Co.—**Lloyd L. Bower** has been appointed chief engineer succeeding **James B. Fisher**, who retired.

Continental Motors Corp.—**Albert B. Willi** has been elected vice-president. He will continue as executive vice-president of Continental Aviation and Engineering Corp.

Optimus Equipment Co. — **Melville Morris** has been appointed executive vice-president and member of the board of directors.

E. W. Bliss Co.—**Louis C. Edgar, Jr.**, has been elected president.

Hudson Motor Car Co.—The appointment of **Glen S. Potter** as service manager has been announced.

B. F. Goodrich Chemical Co.—**Robert P. Kenney**, formerly manager of the international sales department, has been appointed manager of chemical sales. Named successor to Mr. Kenney as manager of international sales is **James C. Richards, Jr.**, formerly sales manager of Hycar American Rubber and rubber chemicals. **W. D. Parrish**, formerly technical service manager for Hycar and rubber chemicals, becomes the new sales manager of that department and is replaced as technical service manager by **Roger C. Bascom.**

Crosley Motors, Inc.—**George M. Hoover** has been appointed quality control director.

Ford International Co.—**Walter D. Appel** has been made vice-president—engineering for the newly-formed company.

Cleveland Hardware and Forging Co.—**L. H. Lundstedt** is now associated with this company, having resigned as sales manager of the A. L. Hansen Mfg. Co.

International Nickel Co. of Canada, Ltd.—**Dr. John F. Thompson**, executive vice president since 1936, and a director and member of the executive committee since 1931, has become president. **Robert C. Stanley**, president since 1922, director since 1917, and chairman and president since 1937, continues as chairman of the board. **Dr. Paul D. Mercia**, vice president since 1936, and a director, has become executive vice-president. **Henry S. Wingate**, secretary since 1939, and a director, has become a vice-president and continues as secretary.

Ford Motor Co.—**Irving A. Duffy** was appointed director of purchasing.

General Motors Corp., AC Spark Plug Div.—**Edgar H. Francois** is named manager of AC's Detroit region, succeeding **Edward H. Merrell**, who leaves the post because of illness. **Juel C. Lindell** has been made manager of the Chicago region, succeeding Mr. Francois. Both sales regions comprise a number of states in the midwest and the near south.

American Brake Shoe Co.—**Kempton Dunn** was elected vice-president and **Cyrus E. Brush** was elected secretary of the company.

B. F. Goodrich Co.—**J. R. Thompson** has been named manager of flat belting, conveyor, elevator and transmission belting in the Industrial Products Sales department of the company, and **Paul W. Van Orden** manager of "V" belts and packing.

Federal Motor Truck Co.—Promotion of **Walter L. Hayes** to assistant general sales manager has been announced.

Jessop Steel Co.—**Miles K. Smith** has been appointed vice president and technical director.

Hydraulic Press Mfg. Co.—The appointment of **John M. Dolan** as vice president in charge of sales has been announced.

Chrysler Corp., Dodge Div.—Appointment of **D. A. Geil** as Omaha regional manager, serving parts of the states of Nebraska, Kansas, Iowa, South Dakota and Wyoming has been announced.

Willys-Overland Motors — **John S. Conant** has been appointed director of procurement. Mr. Conant has been the company's general purchasing agent for the past six months.

Air Reduction Co., Inc.—**Dr. G. V. Slottman** has been appointed director of research and engineering.

Airquipment Co.—**Newman L. Smith** was elected president of the company and of its wholly owned subsidiary Aerol Co., Inc. **Jack Newburn** was elected vice president and general manager.

Circo Products Co.—The appointment of **Norman J. Leary** as manager of industrial sales and service has been announced.

Simmons Fastener Corp.—**Harry H. Rose** has been named general manager.

Willard Storage Battery Co.—**E. M. Slonaker** has been named to direct the company's Related Products Division.

Standard Thomson Corp.—**James P. Malmstrom** has joined the company and will establish an electronics and aircraft equipment division.

Curtiss-Wright Corp.—Four new directors were elected: **John A. McCone, T. Roland Berner, Henry S. Sturgis, and J. F. McCarthy.** Two vice-presidents, **Burdette S. Wright** and **William D. Kennedy.**

Allegheny Ludlum Steel Corp.—**C. A. Scharschu**, director of reasearch, has been appointed assistant technical director. **Dr. L. C. Hicks**, associate director of research, will fill Mr. Scharschu's former position.

(*Turn to page 60, please*)

Necrology

Harry Woodward Beedle, 69, former manager of Boston branch, The Electric Storage Battery Co., died on Feb. 3, 1949.

Kenneth W. Vance, 56, assistant director of the conference of business management, Chrysler Corp., died on Feb. 3 in Detroit.

Jean Pierre Wimille, 41, leading French automobile racing driver, and responsible for the production of a rear-engined sports car bearing his name, was killed while practicing at Buenos Aires.

Hugo L. Olson, 71, president, the Sundstrand Machine Tool Co., Rockford, Ill., and its subsidiary, the American Broach and Machine Co., Ann Arbor, Mich., died on Jan. 31.

Kirk Brown, 88, founder of the Dunlop Tire Co. of America, and one of the organizers of the Bakelite Corp., now a unit of the Union Carbide and Carbon Corp., died Feb. 13 in Bradenton, Fla.

Ernest H. Schebera, 60, founder and former president of the Fleetwood Body Corp., part of GM's Fisher Body Div.; former manager of the commercial dept. of GM's Cadillac Motor Car Div., died on Feb. 7 in Grosse Point, Mich.

Mass Production *versus* General Purpose Machines

(*Continued from page* 20)

machines; and four radial drilling machines.

Mass-production machines required to produce 24 blocks during one eight-hr shift were:

7 Multiple head type milling machines.

1 Two spindle drilling machine.

6 Multiple head, multiple-spindle drilling and tapping machines.

2 Radial drilling machines.

1 Multiple-spindle cylinder boring machine.

1 Multiple-spindle crankshaft and camshaft boring machine.

1 Small pedestal-mounted hand drill.

1 Small hand drill mounted on a swinging arm.

It is estimated that both mass-production machines and general purpose machines average approximately 200 working days per year. This time factor must be kept in mind when equipment recommendations are made, for an idle machine does not produce profit.

In producing different engine block models, general-purpose machines have unlimited flexibility. They cannot only be used for production runs when occasion arises, but they are also widely used for model and pilot engine building. Thus, changeover from one type engine block to another is a very simple matter. Most of the work involved is setting up the block to be machined. When this is accomplished cutting operations follow in an easy normal sequence.

Mass-production machines, by comparison are limited in their flexibility to produce new models. Only minor modification in machining can be accomplished with line equipment.

The relative amount of floor space required for each type of equipment is important. Insofar as conveyors are a basic requirement to carry blocks from one machine to another the amount of floor space for mass-production machines must necessarily be ample. The floor space for the production line being discussed is estimated at 9000 sq ft. This figure anticipates continuous movement of blocks; there is little room or no room for storage. Estimated floor space for horizontal boring machines and radial drills is 3650 sq ft which includes room for storing crankcases.

Now, what is the relative investment for both types of equipment? The approximate cost of general-purpose machines was $250,000, and of mass-production machines and building (converted section of foundry) $525,000. These totals are not exact; they are merely proportionate and will be used generally. These costs are based upon 1943 figures and are not present costs. If the latter were used there would be a tendency to overbalance the factors which would not give a true comparison.

There have been numerous comments recently about amortizing investments for equipment. The reason for the discussion rests largely on what the tax authorities will allow as fair depreciation. Conditions of course, alter the percentage that can be taken. For comparative purposes, consider 10 per cent of actual cost as allowable even though this figure may be scaled up or down. Amortization of general-purpose machines based on a total cost of $250,000 would take ten years. Cost of mass-production machines based upon the same depreciation rate would require a like number of years to amortize. It is unusual to amortize a production line over a ten-year period, especially if model changes occur frequently. Very often all special tools and fixtures are written off the first year, and the machines in a period of four or five years.

Thus, the rate of depreciation determines, in part, the burden each cylinder block produced must bear. Costs, including direct labor, direct expenses and fixed expenses are another added burden and the total of such figures enables the consulting sales engineer to arrive at the final price of the block.

The next step is to estimate the approximate cost of various quantities of clinder blocks, using the fixed and variable costs already obtained and modifying them to suit each problem. In the production problem cited here, these figures were plotted on cross-section paper, using the number of blocks per year as one co-ordinate, and costs per year as the other. A line connecting these points for each method crossed the other at approximately 950 blocks per year, which indicated that the number produced was actually in excess of the number which could be produced economically on general-purpose machines. However, in this instance expediency proved to be a controlling factor and blocks were produced to meet the emergency.

We are now in a position to visualize more clearly the group of factors that have a concrete bearing on the manufacturing problems confronting a builder of engines. For comparative purposes, assume that blocks produced on general-purpose machines cost $84.00 each per 1200 units per year, and that blocks produced on mass-production machines cost $34.40 each per 4800 units per year.

In making comparisons, methods of computing costs were set up so that the same factors were taken into consideration for both methods of manufacture, Fixed expenses include depreciation at 10 per cent per year, while insurance, taxes, repairs and maintenance were based on the cost value of the machinery. Variable items (based on the number of employes, floor space and hours of operation) are items such as personnel department, building expense, first aid, payroll and timekeeping, inspection, transmitted power, lights, heat, lockers and showers, general departmental expense and supervision. All of these items added to direct labor, plus incentive, give a true cost of labor to which must be added material cost to obtain the true cost of the product.

Because the intangible IF factors are unknown it is necessary to take added precautions in anticipating when they will arise. Briefly, the progressive manufacturer will, as far as possible, try to insure a demand for his product. Line equipment to be profitably operated must be kept busy producing the product for which it is designed. Should the manufacturer's demand suddenly be curtailed he must have a cushion to absorb the shock. This may easily be a similar product, or perhaps it may be subcontract work. Whatever it is, it should be a buffer between capacity production and complete shutdown.

Stock piling and availability of material is another important intangible that bears watching. In normal times this might be a remote problem, but we have had abnormal times since December, 1941, and there is no telling when the index will show supply and demand to be again on an even keel.

Labor disputes, strikes, slow-downs, and personnel problems must be taken into the picture. Loss of key personnel is another intangible. Adequate supervision is indispensable when production equipment is used with unskilled labor. Likewise, skilled workmen must always be available when general-purpose equipment is indicated.

The foregoing facts indicate a typical comparison between productive possibilities of two distinct types of equipment. Factors analyzed are based upon what has actually occurred. Such a comparison in retrospect proves easy. The true problem is to determine production methods and procedures in advance.

Dodge and De Soto Cars

(*Continued from page 29*)

electric solenoid. The new valve is simple in design and assembly, self-cleaning, and presents no problems of clearances and fits either at assembly or servicing. To assure smooth operation of the main valve under certain operating conditions, they have added a shuttle valve of spring loaded type which comes into play automatically only when needed.

The improved fluid drive transmission, called the Gyro-matic, is offered by Dodge on one model, the Coronet, as optional equipment. Standard equipment on all Dodge models is the familiar Dodge Fluid Drive.

The rear suspensions have been changed through a "sea-legs" mounting of rear shock absorbers, i.e., inclined to the center of the chassis. The inherent stability of this form of mounting has made possible the elimination of the rear strut used on previous models. At the same time the lower mounting of the shock absorbers has been moved higher up, thus increasing ground clearance. The system of rubber bumpers at the rear end also has been changed to provide better spring action. The rubber bumpers on the axle remain but a rubber bumper has been added on the under side of the frame on each side at the forward half of the rear spring. These are so designed as to make contact before the axle bumpers.

Front suspensions remain substantially the same. However, DeSoto has dropped the spring seats to the lower flange of the lower support arm and lengthened the front springs by 1½ in.

While the engines remain the same in dimensional specifications, improvements have been made to enhance performance, smoothness, and economy. In the first place, they have new 7 to 1 compression ratio heads which, combined with other changes, have raised the De Soto output to 112 hp at 3600 rpm, an increase of three hp, and raised the Dodge peak output to 103 hp at the same speed and torque to 190 lb-ft at 1200 rpm. The new Dodge intake manifold has shorter risers and is designed to give better distribution of the mixture to the cylinders and is said to contribute to quicker and smoother engine warp-up. Improved performance also is gained on the Dodge engine by introduction of a new camshaft with quick-lift, short duration valve timing.

Effective this model year cylinder bores are given the Parko-Lubrite treatment to increase bore and ring life and reduce danger of scuffing during initial break-in.

Fuel pumps are of larger capacity and their design has been improved through elimination of the usual sediment bowl and addition of an air dome on the suction side. Engine quietness is effected by the use of intake silencers of larger volume, specially tuned to the engine.

Many important changes have been made in the electrical systems. First is the adoption of splash-proof distributors designed, in addition, to prevent leakage of high tension current. The distributor caps contain a built-in 10,000-ohm resistor to reduce interference with radio and television reception. Additionally the engines are fitted with new Auto-Lite resistor spark plugs of 14 mm size. This reduces electrode erosion and makes possible the use of an initially wider spark plug electrode gap—0.040 in.—for smoother idle and better low speed performance.

The ignition switch is of new type combining ignition "on" and starter switch as well. Turning the key slightly beyond the "on" position operates the starter switch. The ignition wire from the switch to the engine compartment is armored. Another feature is adoption of a 40-amp generator, the regulator being fitted with a bimetal hinge to cut in maximum output when cold.

Returning to body details, it is of interest that the instrument panel is completely restyled with instruments grouped in front of the driver. Rotary switches replace the push-pull type used before. Improved lighting of the front passenger compartment is afforded by two map lights located under the instrument panel at each door.

A new accelerator pedal and linkage which reduce friction result in improved pedal action. The linkage at the carburetor is further modified when the fluid drive transmission is specified on the Dodge Coronet.

De Soto clutch linkage has been improved to isolate it from the engine and to reduce friction. The linkage is frame-mounted with shafts pivoted in roller bearings. The over-center spring is heavier to reduce pedal effort. The Dodge clutch has been provided with a heavier over-center spring and low friction linkage at the spring connection. Provision is made for adjustment of over-center spring tension and positioning.

The heating and ventilating system has been altered from previous practice by mounting the entire heating system under the hood. The duct system draws fresh air from the front. Air is drawn through the duct to a heating passage and an air chamber. The latter is provided with two independently operated dampers which permit either fresh air or heated air to enter the duct to the car interior. The temperature of heated air is automatically controlled by an adjustable thermostat on the instrument panel on De Soto heaters. This feature is optional on Dodge.

Low pressure super-cushion tires mounted on safety rims are continued as standard equipment.

With the exception of wheelbase, dimensional changes necessary to provide for it, and tire size, all other details of the Dodge Wayfarer chassis and engine are identical as those for the Dodge Coronet and Meadowbrook models.

CALENDAR

Conventions and Meetings

Amer. Soc. of Training Directors, Cleveland .....Mar. 3-5
SAE Passenger Car, Body, Prod. Mfg., Detroit .....Mar. 8-10
Amer. Soc. of Tool Engineers Annual Mtg., Pittsburgh .....Mar. 10-12
Natl. Std. Parts Assn., Regional Business Mtg., Los Angeles .....Mar. 16
Chicago Technical Soc. Council, Annual Production Show, Chicago Mar. 14-17
SAE Transportation Mtg., Cleveland Mar. 28-30
Natl. Std. Parts Assn., Regional Business Mtg., Dallas .....April 6
Metal Powder Assoc. Annual Mtg. & Exhibit, Chicago .....April 5-6
Amer. Inst. Elec. Eng. Conf., Buffalo April 11-12
Amer. Soc. of Lubrication Eng. Annual Show & Convention, New York .....April 11-13
SAE Aeronautic Mtg., New York City .....April 11-13
Amer. Soc. of Metals, Western Metal Congress, Los Angeles .....April 11-16
Midwest Power Conference, Annual Meeting, Chicago .....April 18-20
Magnesium Association Annual Meeting, Chicago .....April 19-20
Salon International DeL' Aeronautique, Paris .....April 29-May 15
Chamber of Commerce of the United States Annual Mtg., Washington May 2-5
Natl. Std. Parts Assn., Regional Business Mtg., Atlanta .....May 9
Amer. Management Assoc. Nat'l. Packaging Exp., Atlantic City May 10-13
Instrument Soc. of America, Annual Mtg., Toronto, Can. .....May 12-13
Soc. for Experimental Stress Analysis Mtg., Detroit .....May 19-21
Natl. Std. Parts Assn., Regional Business Mtg., Philadelphia .....May 22
Middle Atlantic Regional Automotive Show, Phila. .....May 23-30
SAE Summer Mtg., French Lick..June 5-10
American Inst. of Elec. Engineers, Swampscott, Mass. .....June 20-24
Amer. Soc. for Testing Materials Annual Mtg., Atlantic City..June 27-July 1
Amer. Electroplater's Soc. Annual Convention, Milwaukee .....June 27-30
SAE West Coast Mtg., Portland, Ore. Aug. 17-19
Instrument Soc. of America Convention, St. Louis .....Sept. 12-16
Society of Industrial Packaging and Materials Handling Engineers Annual Exposition, Detroit .....Oct. 4-7

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE INDUSTRIES.

Business activity, in general, declined slightly during the first week in February. Electric power production, crude oil output and construction were lower than in the preceding week, but department store sales, railway freight loadings and bituminous coal production increased. The *New York Times* index of activity for the week ended Feb. 5 stands at 150.8, as compared with 152.0 in the preceding week and 150.3 a year ago.

Sales of department stores during the week ended Feb. 5, as reported by the Federal Reserve Board, equaled 231 per cent of the 1935-39 average, as compared with 218 in the week before. Sales were four per cent below the corresponding distribution a year ago, as against a preceding decrease of seven per cent. The total in 1949 so far reported is one per cent greater than the comparable sum in 1948.

Electric power production decreased more than seasonally during the week ended Feb. 5. The output was 7.0 per cent above the corresponding amount in 1948, as compared with a similar advance of 6.1 per cent shown for the preceding week.

Railway freight loadings during the week ended Feb. 5 totaled 682,143 cars, 0.4 per cent more than the figure for the week before but 8.7 per cent below the corresponding number recorded in 1948.

Crude oil production in the week ended Feb. 5 averaged 5,351,200 bbl. daily, 87,650 bbl. less than in the preceding week but 18,625 bbl. above the comparable output in 1948.

Production of bituminous coal and lignite during the week ended Feb. 5 is estimated at 11,360,000 net tons, 8.4 per cent more than the output in the week before but 14.3 per cent below the corresponding quantity in 1948.

Civil engineering construction volume reported for the week ended Feb. 10, according to *Engineering News-Record*, was $131,155,000, 37 per cent less than the preceding weekly figure and two per cent below the comparable sum in 1948. The total recorded for six weeks of this year was 51 per cent more than the corresponding amount in 1948. Private construction was 58 per cent above that a year ago, and public construction increased by 45 per cent.

The wholesale price index of the Bureau of Labor Statistics during the week ended Jan. 25 declined to 156.9 per cent of the 1926 average. The index was 1.2 per cent lower than in the preceding week and 2.5 per cent less than the corresponding figure in 1948. Prices of agricultural and related commodities declined sharply and were held to be the major factors in the decline of the general index.

Member bank reserve balances decreased $114 million during the week ended Feb. 9. Underlying changes thus reflected include increases of $146 million in Treasury deposits with Federal Reserve banks and $9 million in Reserve bank credit, accompanied by a decreased of $26 million in nonmember deposits and other Federal Reserve accounts.

Total loans and investments of reporting member banks decreased $156 million during the week ended Feb. 2. A decline of $63 million in commercial, industrial, and agricultural loans was recorded. The sum of these business loans, $15,318 million, shows a net increase of $593 million in 12 months.

Oliver's Modernized Facilities

(*Continued from page* 36)

the wall areas in two shades of green, ceiling in white, and all machine tools and fixed equipment in a light gray. Machine and machine tool controls are painted blue for easy identification while movable equipment such as cranes, hoists, industrial trucks, etc., is finished in orange. Wherever feasible rough castings are finished in a yellow prime coat so as to be readily distinguishable when mounted in the fixture of a machine. Red is used extensively for safety devices—aisle definition, fire extinguishers, etc.

Another feature of advance planning is that all castings machined in the assembly building are delivered right from the cleaning room of the foundry nearby, coming in on a long monorail conveyor which terminates at the start of the machine shop area.

Foundry Completely Rebuilt

Among the features mentioned at the beginning of this article was the gray iron foundry which was completely rebuilt using foundry equipment of the latest type available today. Included in the program are: A comprehensive sand handling system; an extensive battery of Pangborn dust collectors; three mechanized pouring lines served by individual sand slinger installations; several molding and pouring lines served by mechanical molding machines; and two separate core making departments.

With a rated one shift capacity of 100 tons of gray iron castings per day, melting is done in two No. 10 Whiting cupolas with 96-in. shells, using one cupola at a time, each one operating on alternate days. Molding sand is prepared in an automatically controlled sand mixing system and distributed to the molding floors by a network of belt conveyors. The used sand is returned to the central distributing system by belt conveyors for reuse.

The molding department has been laid out compactly within the available space to house three sand slinger units, and three mechanical molding lines. A feature of the molding lines is the installation of enclosed cooling tunnels over each line starting just past the pouring stations and extending to the shake-out stations.

Two of the sand slinger units each have a capacity of 15 molds per hour, maximum flask size inside of 36 by 66 by 36 in. The third slinger unit takes a smaller sized flask—36 by 54 by 36 in.—and handles 15 molds per hour. The 45-minute cooling cycle in each of these units limits casting section thickness to a maximum of two in.

In keeping with current practice, a feature of the sand slinger installation is the use of a merry-go-round conveyor at each sand slinger station, carrying four fixtures.

On the mechanical molding lines, there is a cope and drag jolt unit with a capacity of 55 molds per hour, handling flasks 18 by 36 by 20 in.; one squeezer unit with capacity of 160 molds per hour, handling flasks up to 14 by 16 by 8 in.; and a medium sized cope and drag jolt unit with a capacity of 20 molds per hour, handling flasks 18 by 42 by 20 in.

Core making has been divided into two independent operations — small cores, and large cores. Depending upon the size and type of core as well as the quantities involved, cores are made by hand on benches, or on machines or core blowers. Core sand is distributed by a mechanized overhead sand handling system to all work places. Cores ready for baking are placed in trays on multiple tray carriers and transported through the departments to the ovens on a heavy duty monorail conveyor.

The core department has a system of three Despatch horizontal continuous conveyor type baking ovens, one for small cores, two for large cores. The core oven for the small core department has a capacity of 6000 lb per hour, maximum weight of an individual core being held to 50 lb. The large core oven has a capacity of 10,000 lb of cores per hour. Maximum weight per core is held to 500 lb while size is held to 12 by 18 by 60 in. The smaller core oven in the large core division has a capacity of 2200 lb per hour, holding maximum weight to 40 lb.

All of the castings produced in this foundry are cleaned by shot blasting in Pangborn equipment, either in a barrel type cleaning unit or a room type unit depending upon the size of the casting. The barrel type unit has a capacity of eight tons per hour, the maximum size of casting being held to 200 lb. The room type unit has a capacity of 12 tons per hour and handles castings up to 600 lb in weight with a maximum size of 16 by 18 by 48 in. All castings are routed to the cleaning room for grinding and snagging and, in some cases, targeting for location before delivery to the machine shop.

World's Largest Highway Unit

(*Continued from page* 32)

shown on the figure together with the recommended location of load concentrations as a three unit combination. Distribution of the loads shown is calculated. The tire capabilities shown are based upon the recommended inflation pressures of 80 psi for the tractor tires and 110 psi for the Jeep and low bed semi-trailer tires.

NEWS *of the* AUTOMOTIVE INDUSTRIES

(*Continued from page* 17)

Sun Electric Corp. Opens New Chicago Technical Center

The Sun Electric Corp. has opened a new Sun Technical Training Center in Chicago, according to O. L. Rhoades, president. The Chicago building also provides permanent offices for Sun's education and training staff under the supervision of W. W. Squier, director of education. Other Sun Technical Training Centers have previously been opened at New York, Detroit, Oakland and Denver. Several more will be put into active operation early in 1949.

Ford Forms Ind'l Relations Dept. for Rouge Automotive Operations

The Ford Motor Co. has announced the establishment of an industrial relations department for the Rouge Automotive Operations. Logan Miller, general manager, Rouge Automotive Operations, has appointed E. M. Baker, former manager of the Hourly Personnel Dept., as manager of the new industrial relations department.

Army Sets Up Procurement Information Center

A Procurement Information Center has been established in the Office of the Assistant Secretary of the Army to supply information concerning Army procurement of supplies and equipment. Information concerning current Army procurement programs, submission of bids, buying and purchasing offices, and abstracts of bids will be made available at the Procurement Information Center. Prospective bidders and manufacturers interested in securing information may address letters to the Procurement Information Center, Office of The Assistant Secretary of the Army, Room 4E789, National Defense Building (The Pentagon), Washington 25, D. C.

NEW TRUCK REGISTRATIONS*

Arranged by Makes in Descending Order According to the Twelve Months' Total

MAKE	December 1948	November 1948	December 1947	TWELVE MONTHS Units 1948	Units 1947	Per Cent of Total 1948	Per Cent of Total 1947
Chevrolet	23,802	23,694	27,933	302,219	235,803	29.19	26.82
Ford	12,371	14,125	4,887	225,729	186,414	21.81	21.20
International	6,945	7,884	8,501	125,203	113,151	12.09	12.87
Dodge	8,419	8,682	8,255	114,431	126,736	11.05	14.42
G.M.C.	5,898	6,764	4,547	74,857	49,187	7.23	5.59
Studebaker	4,287	4,356	3,469	50,057	41,961	4.89	4.76
Willys Jeep	2,401	2,662	3,597	48,644	47,612	4.70	5.42
Willys Truck	2,467	2,384	898	27,840	2,207	2.69	.25
White	664	961	1,002	11,603	13,086	1.12	1.49
Reo	620	580	958	10,773	12,911	1.04	1.47
Diamond T	574	707	706	10,657	10,475	1.03	1.19
Mack	590	548	908	9,795	10,917	.95	1.24
Divco	251	319	371	5,610	4,893	.54	.56
Federal	115	223	483	4,026	6,020	.39	.68
Brockway	177	270	325	2,958	4,255	.29	.48
Autocar	210	254	299	2,770	4,334	.27	.49
Crosley	109	153	.....	2,411	.....	.23	.....
F.W.D.	23	61	79	811	1,195	.08	.14
Kenworth	58	49	41	479	487	.05	.06
Sterling	24	15	31	411	576	.04	.07
Ward La France	9	14	35	271	509	.03	.06
Oshkosh	13	10	23	173	245	.02	.03
Hudson	1	3	20	117	2,534	.01	.29
Nash	12	3	.....	32	.....	.....	.....
All Others	242	303	423	2,690	3,724	.26	.42
Total	70,282	75,024	67,990	1,038,174	879,132	100.00	100.00

* Data from R. L. Polk & Co.

NEW PASSENGER CAR REGISTRATIONS*

Arranged by Makes in Descending Order According to the Twelve Months' Total

MAKE	December 1948	November 1948	December 1947	TWELVE MONTHS Units 1948	Units 1947	Per Cent of Total 1948	Per Cent of Total 1947
Chevrolet	59,153	60,920	64,275	709,609	640,709	20.33	20.23
Ford	57,847	58,521	52,071	486,888	532,646	13.95	16.82
Plymouth	33,242	35,832	30,677	347,174	313,118	9.94	9.89
Buick	21,082	14,957	23,595	244,762	246,115	7.01	7.77
Pontiac	19,622	19,224	20,656	228,939	206,411	6.56	6.52
Dodge	21,213	19,155	20,436	213,923	209,582	6.13	6.62
Oldsmobile	9,352	14,089	16,565	175,531	180,078	5.03	5.69
Studebaker	11,219	11,833	10,019	143,120	102,123	4.10	3.22
Mercury	11,887	14,423	13,320	137,512	111,198	3.94	3.51
Hudson	11,581	9,912	2,494	109,497	83,344	3.14	2.63
Kaiser	5,145	6,411	6,351	106,367	55,571	3.10	1.75
Chrysler	9,787	9,341	9,293	105,315	93,571	3.02	2.96
Nash	7,543	7,452	8,895	104,156	102,808	2.98	3.25
De Soto	7,848	7,902	7,381	82,454	72,966	2.36	2.30
Packard	7,627	6,758	4,909	77,843	47,875	2.23	1.51
Cadillac	5,091	3,757	6,275	59,379	53,379	1.70	1.68
Frazer	3,432	3,831	7,123	57,994	51,156	1.66	1.62
Lincoln	4,328	3,897	2,360	32,638	24,081	.93	.76
Crosley	1,074	1,331	1,479	25,480	15,934	.73	.50
Willys	1,964	2,030	1,914	21,408	23,400	.61	.74
Austin	296	424	.....	8,610	.....	.25	.....
British Ford	504	392	.....	3,223	.....	.09	.....
Playboy	3	.....	.....	61	.....	.....	.....
Tucker	.....	1	.....	3	.....	.....	.....
All Others	569	837	175	7,146	894	.21	.03
Total	311,419	313,230	312,263	3,490,952	3,167,231	100.00	100.00

* Data from R. L. Polk & Co.

Select 1949 Ford for Fashion Award

The Ford Motor Co. is apparently cashing in on its decision to include women in its styling section. The 1949 Ford has been selected to receive the Fashion Academy Award as "America's Fashion Car of the Year." The choice was made on the excellence of design and styling appeal for women. The award will be presented formally in conjunction with the selection of America's best dressed women for 1949.

Form Fuel & Lubricants Group for Military Research

The formation of a committee to determine policies on research and development in the field of fuels and lubricants as they affect the National Military Establishment has been announced by the Research and Development Board. W. M. Holaday, director of research for the Socony-Vacuum Oil Co., has been named chairman of the committee.

Snyder Tool Buys Colton Co.

The Snyder Tool & Engineering Co., Detroit, manufacturer of production machines for the automotive industries, has purchased the Arthur Colton Co., Detroit.

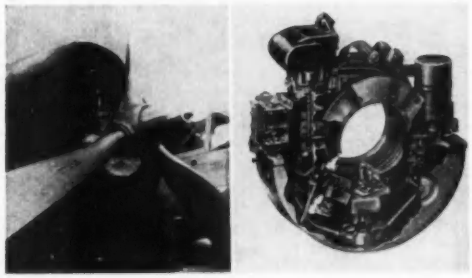
NEW Products for AIRCRAFT

For additional information regarding any of these items, please use coupon on page 47.

R-1—Supply Unit For Propeller Oil

Hamilton Standard Propellers division of United Aircraft Corp, E. Hartford, Conn., has started delivery to the military services of a self-contained oil supply and accessory section unit for Hydromatic propellers. The recently developed unit is suited to certain military aircraft where propeller operation using engine oil may not be desirable.

This integral oil control assembly has passed Air Force and Navy type tests for use on the Air Force's Boeing C-97 Stratofreighter, Fairchild C-119 Packet, Douglas C-124 Globemaster, Grumman SA-16 and Chase C-123, and the Navy's Fairchild R4Q Packet and Grumman JR2F Albatross.



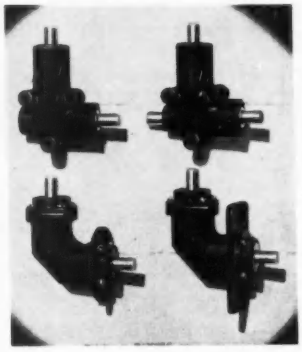
Hamilton Standard reversing Hydromatic propeller with integral oil control assembly mounted at rear of propeller hub. Cutaway of assembly shown at right

By employing an oil supply separate from that of the engine, Hamilton Standard's hydraulically-operated propellers can now use a fluid medium suitable primarily for the propeller. Containing larger capacity pumps and operating on lighter oil, the assembly permits employment of propellers having larger, wider blades for higher power absorption and greater thrust and meeting high takeoff and climb requirements of modern military transport. Also important in the military field is the fact that enemy damage to either the engine or propeller will not adversely affect the pilot's control of the other.

The new assembly comprises a complete accessory unit and a tank to hold the propeller oil mounted at rear of the propeller hub. It concentrates all fundamental operating functions of the propeller in one compact section. The hydraulic pumps, governor, auxiliary motor for feathering and reversing, and the control valves are all contained in the single unit.

R-2—Bevel Gear Drive Units

Called "ANGLgear," standardized right angle bevel gear drive units for simplifying mechanical transmission design, are announced by Airborne Accessories Corp., Hillside, N. J. Originally developed for the exacting requirements of latest military and commercial aircraft, the units are also suitable for high-grade industrial uses in manual or power operated systems. They are furnished in four models of two basic sizes —heavy duty and light duty—in standard one to one ratios.



Airborne "ANGLgear" standardized right angle bevel gear drive units.

Heavy duty model R-160 is the circular flange mounted right angle type; heavy duty model R-190, the rectangular flange mounted right angle type interchangeable with Air Corps design 37B4319. Both are rated at 500 in. lb ultimate static load.

Medium duty model R-200 is a three hole mounted right angle type; medium duty model R-210, a three hole mounted "Tee" type, each rated at 250 in. lb ultimate static load.

The heavy duty models can be furnished with a pressurized shaft seal when required, such as currently reported employed on Republic F-84 "Thunderjet" fighters.

All materials, tolerances and lubrication are suitable for operation in the range of —65 F to +160 F.

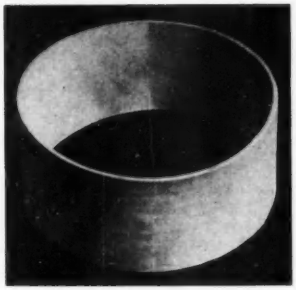
R-3—Fire-Resistant Hydraulic Fluid

A new fire-resistant hydraulic fluid —to be known by the name of Skydrol— for use in aviation for actuating landing gear, flaps and other mechanisms, is disclosed in a joint announcement by the Douglas Aircraft Co., Inc., Santa Monica, Calif., and Monsanto Chemical Co., Los Angeles, Calif. The new fluid is described as a synthetic liquid combining most of the desirable characteristics of existing hydraulic fluids with fire resistant qualities never before attained.

In addition to its fire-resistant qualities, the fluid is said to include a high viscosity index with little change of viscosity over a wide temperature range and a lubricity greatly extending the life of pumps and other moving parts.

R-4—Fiberglas Silicone Rubber Sleeve

Extremely important requirement to supply large volumes of high temperature air in newer military aircraft at high altitudes is said to be solved by a fiberglas silicone rubber flexible sleeve manufactured by the Connecticut Hard Rubber Co., New Haven, Conn. This air, needed to keep crew members and intricate machinery from freezing and for deicing work on parts of the ship, generally blows through hard ducts joined by flexible connections, the performance of the connections creating the problem.



Connecticut fiberglas silicone rubber flexible sleeve

Connecticut Hard Rubber Company's sleeve is said to permit passage of air at temperatures of 550 F, to withstand internal air pressures of five to ten lb without leakage, and to remain flexible down to —75 F.

Advance Methods of Mixture Control

(*Continued from page 26*)

conventional carburetor in that metering of the fuel always is effected by means of a calibrated orifice subjected to a vacuum engendered by passage of the air through a suitable venturi. In another type the fuel is metered by a pump which rotates at a speed proportional to that of the engine and the effective displacement of which is varied in accordance with the intake-manifold pressure. With these systems atomization of the fuel is effected under high pressure by means of atomizers located beyond (downstream from) the throttle which deliver the fuel either into a manifold serving a number of cylinders or into the inlet-valve domes. This gives rise to two different arrangements.

In the Scintilla system (Fig. 4) the variable delivery pump is of the barrel type, its plungers being set in motion by a swashplate. This pump is driven from the generator shaft and is not synchronized. Its delivery is controlled in the usual manner of Bosch Diesel pumps, by means of a rotary valve which varies the effective stroke of the plunger. This valve is controlled by a manometric capsule subject to the pressure in the intake manifold.

The fuel is delivered under a rather high pressure (30 to 45 psi) and sprayed by a single injector located in the axis of a sort of "cyclone" (evidently a device designed to produce turbulence) at the entrance to the inlet manifold. This arrangement ensures good atomization, which favors distribution, but irregularities in the distribution are not entirely prevented, owing to the use of a manifold. Neither are metering difficulties at small loads and low speeds entirely eliminated, because under these conditions the vacuum transmitted to the manometric capsule is very small.

In order to avoid condensation of fuel in the inlet manifold and difficulties of distribution, the Brandt company places a spraying injector at the entrance to each inlet dome. These injectors are supplied with fuel by a pump of the Diesel type, synchronized by a positive half-speed drive. Injection begins shortly after the opening of the inlet valve and continues during a fraction of the inlet stroke. The delivery is controlled in the same way as in Diesel pumps, by means of a set of sleeve valves acted on by a rack connected by a linkage to a pressure capsule acted on by the inlet-manifold pressure.

Tests have shown the important influence of the timing of the injection period with respect to the inlet stroke, the influence of turbulence at the inlet valves, and the advisability of changing the injection timing when changing from a fuel with high latent heat of vaporization, such as alcohol, to one with low latent heat, such as gasoline.

Direct Injection

Direct injection of fuel into the cylinders by means of a variable-stroke metering pump whose stroke is varied automatically in accordance with the inlet-manifold pressure is historically the first system to have entered into active competition with the conventional carburetor, having been adopted to overcome the defects of the latter. This method of introducing the fuel solves the distribution problem by supplying each cylinder separately. If the pumps and injectors are produced with sufficient accuracy, one may count on the delivery of equal quantities of fuel to all cylinders. The problem of mixture quality is solved by injecting the fuel under high pressure through very fine orifices, which insures a high degree of atomization. The metering problem may be solved by means of more or less complicated methods, such as changing the volume injected (in constant-volume systems) or changing the time of injection (in constant-pressure systems), as a function of the quantity of air aspirated.

The volumetric efficiency is increased because the space ordinarily occupied by the fuel, whether in the liquid or gaseous state, is available for additional air. The efficiency is increased by reason of the lowering of all temperatures of the cycle, due to intense vaporization throughout the compression stroke. The threshold of detonation is pushed back by the lower temperature of the charge at the end of compression. All danger of carburetor icing and backfires through the carburetor is eliminated, because only pure air passes through the inlet tract.

There are, however, a number of objections to the direct-injection system. First among these is the complication of the equipment required. Thus in the case of a four-cylinder engine the conventional carburetor is replaced by an injection pump, a mechanical drive, four injectors, and a system of connecting tubing. The injection pump alone is much more complicated than the carburetor which it replaces. Tolerances on parts of the injection pump must be of the order of one one-hundred-thousandth of an inch. The cams and plungers must be made of high-grade steel and machined to a very high degree of accuracy. The injection equipment comprises numerous parts subjected to wear, in consequence of which the likelihood of breakdowns and costly maintenance is increased. It is, moreover, quite sensitive to impurities and gum in the fuel. The metering will change gradually in the course of service as a result of wear of the plungers and of the injector orifices. Imperfections in the piping system may prevent optimum metering at small loads, when the quantities to be injected become exceedingly small. It is particularly difficult to ensure good idling with this system. Finally, the high cost of the equipment is a serious objection.

It is for these reasons that direct injection, in spite of its undisputable thermodynamic advantages, has not yet superseded the conventional carburetor, except to a certain degree in the aircraft field. There the elimination of carburetor icing and of the serious hazard presented by the presence of more than one cu ft of combustible mixture, precompressed to the supercharging pressure, in itself justifies recourse to the direct injection system. M. Carbonaro mentions in this connection that even in the U. S., where for a long time there was strong objection to the new practice, Wright engines were equipped with fuel injection systems after serious losses of Constellation planes. Extension of the system to the automobile field is dependent on the development of injection pumps of very small displacement and on a reduction of the cost of the equipment. Some recent developments, such as the Ex-Cell-O and the Retel II pumps, show considerable progress in that direction.

Numerous direct-injection systems have been developed, and these may be divided into three groups. The first group effects injection by means of a non-synchronized, single-unit pump under medium pressure (300-700 psi), the pump supplying the different cylinders in succession through a rotating distributor connected to open injector valves (Retel I). With the second type injection is by a multiple-unit pump operating under very high pressure (3500 psi), each pump unit supplying a single cylinder through a closed injector valve (Brandt) or an open valve (Junkers, Deckel). With the third type injection is by a synchronized, single-cylinder pump under very high pressure, the pump plunger turning around its axis and serving as a distributor at the same time, delivering successively to the separate injectors (Retal II).

In M. Carbonaro's opinion, the most successful representative of the system of injection under constant pressure by a synchronized pump and distributor is that developed by M. Retel. The pump, of which an axial section is shown in Fig. 5, has a rotating piston

which delivers fuel successively to the individual cylinders of the engine. Reciprocating motion is communicated to the piston by internal rollers rolling on the face cam 5. The delivery depends on the stroke of the piston, which is determined by a slide 7 carrying the plane on which rest the external rollers. The level of this plane depends on the inclination of ring 8 controlling the slide. It is controlled, by means of cam 9 and lever 12, by the automatic regulator, which latter serves the function of metering the fuel supply in proportion to the mass of air admitted.

In order to take account of changes in the heat value of the fuel it must be possible to modify the amplitude of the motion imparted by the slide to the cam. To this end the outer portion of the ring is made to rest on knife edges 10, whose distance from the axis of the apparatus can be changed by means of the regulating screw 11. This arrangement also permits of adjusting the richness of the mixture while the vehicle is in motion, by means of an adjusting screw on the instrument board.

Direct injection by a synchronized pump under high pressure is very similar to injection in Diesel engines, most of the units employed being adapted from that field. The only addition worth mentioning is a device designed to proportion the fuel delivery to the mass-rate of air flow past the throttle valve. The development of such a control device constitutes the principal problem encountered. Theoretically the mass of air aspirated is proportional to the pressure and to the temperature beyond the throttle valve, and it suffices to control the valve which regulates the delivery of the pump by a pressure capsule whose movements are a linear function of the absolute pressure in the inlet manifold, these linear movements in turn being converted by a helicoidal ramp into a linear variation of the effective stroke of the pump plunger. In practice the control mechanism of the pump frequently shows considerable complication. A feature of the Brandt system (Fig. 6) is that the piston of each injection unit is stepped, thus forming an additional pump chamber which displaces lubricating oil, the latter providing a pressure oil seal for the fuel-pump plunger and at the same time lubricating the valve of the injector, which is screwed into the cylinder wall.

With a view to cost reduction M. Retel recently developed a new injection system by which a four-cylinder engine is supplied with fuel by four injectors all of which are connected to a single-cylinder injection pump. Such single-cylinder injection pumps for four-cylinder engines were first employed on Diesel engines by the International Harvester Co. in this country, we believe.

Constant Air, Variable Fuel Charge

To obviate the defects inherent in the principle of "pre-carburetion," such as sensitiveness to detonation, reduction of the thermal efficiency at light loads, and particularly the impossibility of operating on very lean mixtures, there has been a tendency recently to admit the same amount of air to the cylinders under all conditions of load and to vary the fuel supply to suit the load. This is possible only with direct injection and by taking advantage of the phenomenon of stratification. Under these conditions the spark points will be surrounded by a mixture that is readily inflammable, and this core of rich mixture will be surrounded by an atmosphere in which the richness decreases with distance from the spark gap. Although these mixtures are too lean to be ignited directly by the spark, they will burn under the conditions of pressure and temperature set up in advance of the flame front once ignition has been effected. this practice constitutes a vertiable revolution in methods of fuel feed, as it permits of dispensing with means for maintaining proportionality between the air and fuel charges, which present a problem that is difficult to solve in the case of direct injection. On the other hand, this system makes it possible, by suitably controlling the injection and turbulence of the mixture, to obtain an engine that is practically insensitive to the antidetonating quality of the fuel used.

This method of operation has been investigated particularly by Messrs. Barber, Malin and Mikita, of the Beacon, N. Y., Laboratory of the Texas Co. They inject the fuel directly into a small portion of the combustion chamber immediately ahead of the flame front. The rate of injection is controlled to correspond to the rate of flame travel, so that the fuel is burned at the rate at which it is injected, until the air charge is exhausted. A rotary motion is imparted to the air entering the cylinder by a masked inlet valve. The cone of atomized fuel issuing from the injector remains stationary, and the flame front remains fixed in position, its velocity being equal in value and opposite in direction to that of the air swirl. Extended tests were made to determine the optimum spark advance, the angular position of the spark plug with relation to the injector, the injection advance relative to the top dead center, the duration of injection for a given injection quantity, and the angle of the spray cone. It was found possible to obtain satisfactory operation regardless of the octane value of the fuel. Entirely different fuels gave the same performance, and the specific consumption was unusually low for fuel/air ratios only about one-fourth the chemically correct ratio.

The method employed by Barber and his associates is not entirely original, however, because the Hesselman engine operates without detonation on practically the same principle, with a compression ratio of 6.5, with the highly detonating gas oil and Diesel oil. The Hesselman engine also makes use of the masked valve, direct injection in the vicinity of the exhaust valve, and spark ignition.

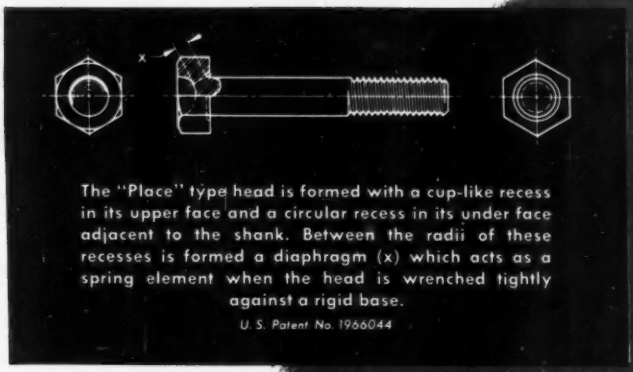
Another feature of the Barber engine is that the air admission is constant regardless of the load. This same principle is made use of by M. Fabien of the C.G.M. at Lille in an alcohol engine which operates without throttling of the air supply.

Constant air admission, which evidently results in a constant compression, gives a specific consumption curve which drops continually with the speed, in contrast to conditions existing with throttle-controlled carburetor engines. This method of operation permits of particularly high economy at low speeds. It is possible only with direct injection and stratification of the charge, under which conditions electric ignition is practicable with fuel charges which, on the basis of the full air charge give a mixture three to four times leaner than the theoretically correct mixture.

Fig. 7 is a sectional view of the Starr engine, which, with compression ratios of 7.5 to 10, operates with constant air charges and stratified mixtures. The engine is of the ante-chamber type and is so designed that during the compression stroke the fuel injected by the injector remains at the top of the chamber near the spark plug. This engine operates as a constant-charge engine down to one-fourth load, the richness of the mixture decreasing from 100 to 25 per cent. Below one-fourth load two out of the four cylinders receive no fuel and cease to operate, whereas the supply of fuel to the other two is instantly increased to 50 per cent of the maximum. A further reduction in load, down to one-eighth, is accomplished by once more reducing the richness of the charge to one-fourth the theoretical. This engine is said to be substantially independent of the octane number of the fuel used, operating just as well on fuel oil of 0.855 specific gravity as on gasoline. However, gasolines of medium octane number are said to give the best results. A similar technique is followed in France by M. Fabien with a C.L.M. two-stroke engine with two pistons in each cylinder and fuel injection. Results obtained were similar to those described above, which confirms the value of the principle of operating with full air charges under all load conditions.

Univ. of Minnesota to Hold Engineering Symposium

The University of Minnesota will conduct a symposium on cooperative engineering research March 14-16, 1949. The symposium will be presented with the cooperation of the Minnesota chapter of the American Society of Engineering Education, and will seek to bring about better understanding and a closer relationship in cooperative engineering research between universities, industries and governmental agencies.



The "Place" type head is formed with a cup-like recess in its upper face and a circular recess in its under face adjacent to the shank. Between the radii of these recesses is formed a diaphragm (x) which acts as a spring element when the head is wrenched tightly against a rigid base.

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Developing Aircraft Gas Turbines

(*Continued from page 27*)

that of obtaining full sized parts, and the evaluation of ultimate engine sizes in future years.

Most impressive of the new component test facilities is the full scale compressor test stand capable of full scale testing of compressors considerably larger than any currently in production. The stand has a closed-cycle air system providing complete control of the air temperature, pressure and humidity at the compressor inlet. Air temperature can be controlled from one and one-half atmospheres to that obtaining at 70,000 ft altitude, and humidities upward from one-half grain per lb of air. Power is supplied to the test compressor from a tandem compound 30,000 hp condensing steam turbine through a three-speed gear set.

By changing gear ratios, full power is available over the complete speed range of from 4000 to 14,000 rpm. Power measurements to the compressor are made by a precision torque meter located on the gear output shaft.

The cooling and refrigeration system of this new stand is capable of removing 75 million Btu per hour from the compressor air. Because of the wide range of temperature operation, the moisture content of the air must be controlled. This is done by initially evacuating the system and charging it with air through a silica gel dryer to reduce its moisture content.

Facilities are also provided for full scale turbine testing, matching the size of compressors being tested in the compressor test stand. These tests are carried on in a specially built and protected test cell, to which metered air from the full scale compressor test stand can be fed. When so operated, the compressor test is operated on the open cycle principle. Special combustion chambers are provided to supply the turbine with gas at temperatures up to 1700 F, and at the pressure at which the turbine will normally operate at sea level and low altitudes.

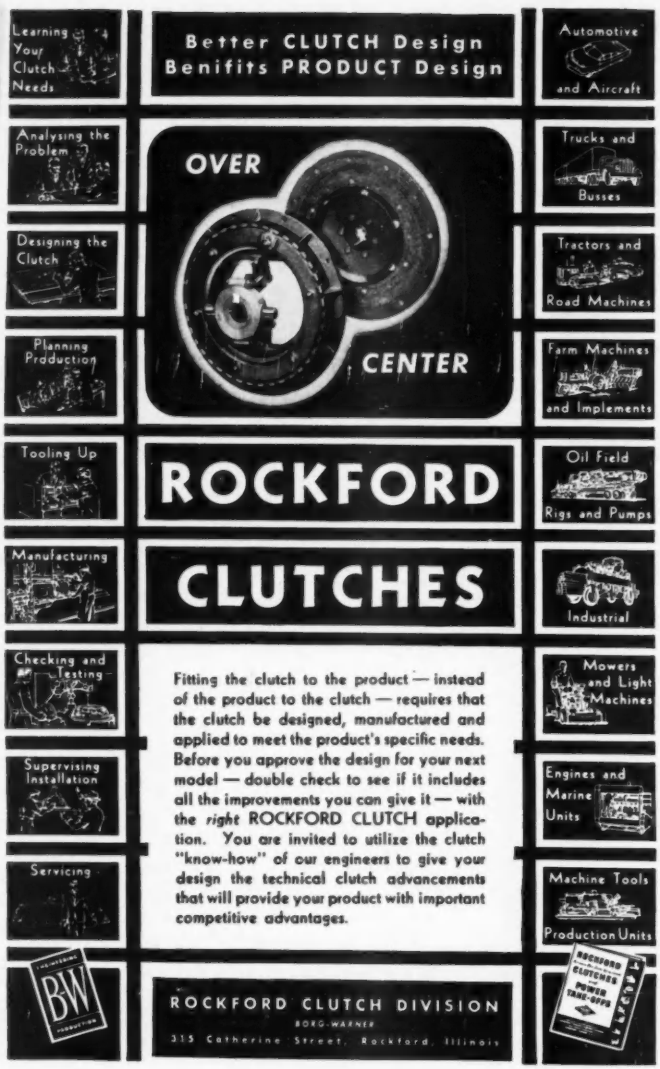
The power output of the turbine is delivered to a cradled variable speed, variable density, steam dynamometer capable of absorbing in excess of 30,000 hp at speeds up to 9000 rpm. Provisions are made to operate the turbine with its normal engine combustion system or with a special combustion system supplying gas at uniform temperatures and pressures.

The combustion research stand also receives air from the compressor test stand and is capable of testing full size engine combustion systems under sea level and low altitude conditions.

Compressor design theories and design constants are evaluated on a scale model test stand built to investigate single and multi-stage test-model compressors. A closed cycle system is used in which an airflow of 22 lb per second can be handled at sea level pressure. The pressure level can be varied from one and one-half atmospheres to that found at an altitude of 70,000 ft with temperature control from —70 F to 150 F by the use of a special compression, cooling and expansion cycle. The complete temperature, pressure and flow range can be covered even to the point of negative pressure rise through a group of stages. Power is supplied to the stages under test from a 2000-hp wide-speed range, cradle-mounted steam turbine.

Engine accessories and controls are developed in a separate section containing 16 distinct test stands. Controls, lubrication systems, fuel and oil pumps, starters, ignition and other accessories can be developed in test stands giving conditions operating from —65 F to 160 F, and at pressures from one and one-half atmospheres to the atmospheric pressure at 70,000 ft.

While major component jet parts,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such as the turbine and compressor, can be tested in the new laboratory under simulated and varying flight conditions, testing of complete jet engines is dependent upon other facilities.

At the General Electric flight test center near Schenectady, N. Y., flight testing of jet engines is carried on aboard a B-29 that is used as a flying laboratory. In this test plane engines, hung below the plane's fuselage, are checked out at various altitudes and flight conditions. Icing tests, starts, acceleration, and instrumentation and installation studies are made on latest engines such as the TG-190.

Extensive jet engine flight test programs are being conducted by the Air Force with the latest in jet-powered military aircraft at bases such as Muroc, Calif. and Wright-Patterson in Ohio.

Other full-size engine tests are run by NACA in its wind tunnel at Cleveland, Ohio. This facility permits more thorough and careful analysis of engine operating conditions and performance with better instrumentation than is normally possible in flight testing. In addition, vibration, temperature, and gas flow patterns have been checked in this way.

Most of the full-size engine testing, however, has to date been done in static sea level test chambers at G-E's Aircraft Gas Turbine Plant in Lynn, Mass. Since the close of the war, thousands of hours of endurance and performance testing has been run in these cells to check the latest General Electric designs and material.

In addition to proving out reaction jets, tests in special cells are being carried on for turbo-prop engines. Here controls for coupling the engine to the propeller are being worked out and the general engine performance closely analyzed.

Research and development testing of combustors, in addition to the full scale component testing, is carried on in separate cells where simulated engine conditions may be duplicated from sea level to high altitude.

Many of the older test cells from the early turbo supercharger days have been converted to basic test uses for testing such items as new type bearings and seals, to the satisfaction of the materials and development engineers.

Closely allied with this jet engine development program has been the laboratory work where much of the basic development on the high temperature alloys needed in the new type power plant has been done. Long before the first General Electric-powered jet planes took to the air, metallurgists and engineers of the company's high temperature laboratories were studying carefully the metallurgical aspects involved.

As the result of this work, forging techniques were developed for high temperature alloys. Welding techniques for fabrication of the new metals used in the jet engine were developed as well as new methods for testing these alloys, so that indications of their efficiency could be obtained much faster than previously.

Production of other specialized items has contributed much to the development of better and larger jet engines. G-E's Motor Division is designing and producing starter-generators suitable for jet aircraft installation, and the Instrument Division is at work on special instruments including thermocouple design and development. The Plastics Division is developing high temperature "silicone" sealing gaskets, while the Gear Division is at work on new high-load gears and splines.

It is by the cooperative effort of all of these laboratories, research and development groups that new and improved designs of jet engines are possible.

Leyland Using Aluminum Alloy for Driver's Cabs

Leyland Motors Ltd., England, is now extensively using a selected aluminum alloy on the driver's cab for Leyland forward-controlled heavy-duty vehicles. Panels which were previously 20-gage sheet steel are now made of 18- and 20-gage aluminum alloy.

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Personals

(*Continued from page* 49)

Ford Motor Co.—**E. C. Herschelman** has been appointed assistant resident controller at the Highland Park plant. Mr. Herschelman replaces **John L. Hazebrook,** who was named resident controller of the Lincoln plant.

Modern Collet & Machine Co.—**Joseph F. Lask** has been appointed general manager and **John L. Bradford** as sales manager.

Fedders-Quigan Corp. — Announcement is made of the election of **August F. Ihde** as vice-president in charge of automotive sales and the appointment of **Anthony J. DeFino** as sales manager of the Automotive Division.

Central Ohio Products Co.—**B. John Heiser** has been elected president succeeding **Gilbert L. Stiefel,** who died last September.

Mack Trucks, Inc.—The following district managers have been appointed: **J. E. Donovan** in charge of the San Francisco Branch; **J. W. Biggins** in charge of the Louisville Branch; **H. J. Fikkejs** in charge of the Kansas City Branch; **T. J. Colter** in charge of the Milwaukee Branch; **A. P. Cowles** in charge of the Springfield (Mass.) Branch; and **R. J. McGivney** in charge of the Worcester (Mass.) Branch.

American Smelting and Refining Co., Federated Metals Division—**H. L. Smith** has been appointed to the newly created position of executive technical engineer.

Hydraulic Equipment Co.—**Edward J. Hrdlicka** has been appointed vice-president.

Seiberling Rubber Co. — **James H. Higgins** was appointed manager of the manufacturers' sales department.

American Coach & Body Co.—**Paul V. Dimmick** succeeds **Deming Bronson** as Central Division sales manager with headquarters at Cleveland, Ohio. Assisting Mr. Dimmick will be **Arthur C. Frank.** Mr. Frank has been sales and service engineer in the home office.

Bill Asks Guaranteed Wage Clause in War Contract

A guaranteed annual wage for workers of companies selling supplies of any kind to the federal government would become a part of all government contracts if a bill introduced in Congress becomes law. Specifically, the contracts would bear a stipulation that each employe be assured in advance of at least 30 hours of wages for a minimum of 40 weeks in any 12 months. Contracts for less than $10,000 would be exempt. The measure is sponsored by Senators Lodge and McMahon.

BOOKS ...

PRACTICAL CONSIDERATIONS IN DIE CASTING DESIGN—pub. *The New Jersey Zinc Co.* Although the die casting art is not new, the changing trends in product design, problems of manufacturing economy, and the endless competition of materials and methods in the mass production industries require that engineers and production men alike must have a better understanding of its potentiatities. The New Jersey Zinc Co. has performed a service to the industry in the publication of this text on die casting design. Profusely illustrated, the book has been prepared for practical use by everyone concerned with the art. It is a fitting successor to the earlier text "Die Casting for Engineers," which was issued in 1942. Among the topics treated in the book are: section thickness; where intricacy is an asset; fillets and edges; wheels, gears, and cams; how design affects flash removal; how design influences polishing costs. We recommend the book to engineers, designers, and production men.

MATHEMATICS AT WORK, by *H. L. Horton*, published by the *Industrial Press, 148 Lafayette St., New York City.* This is a comprehensive working manual that shows by means of step-by-step analysis and example how arithmetic, algebra, geometry, trigonometry and logarithms are applied to the solution of mechanical problems taken from actual shop and drafting room practice. The book gives a concise review of the fundamentals of these five basic subjects. It discusses approximate formulas, trial and error solutions, empirical formulas and other problem-solving aids and shows how each is employed. Many doubtful points in mathematics, mechanics and strength of materials encountered in mechanical work are cleared up by means of refresher questions and answers. In addition, there are 145 pages of standard mathematical tables to facilitate computations. The book, in simulated leather binding, is priced at $6.00.

Steel Balls Reduce Friction Between Spring Leaves

(*Continued from page* 33)

and the five leaves of Commander front springs that come next to the main leaves. Before the leaves are fastened together, one of the two-in. patches of shot-covered tape is applied about ¼ in. from the ends of the respective leaves where the cement holds the patch in place. The length of each patch is equal to the leaf width.

After center bolts are installed, the spring assemblies are stacked for delivery to the stands where spring covers are fastened in place after applying lubricant to spring surfaces. Springs are then ready for assembly to chassis.

Hudson Engine Balancing Techniques

(*Continued from page* 21)

angular location of corrective drilling and depth of drill is established automatically by the machine.

At the present writing both machines are actually in production operation. For the time being, after corrective drilling has been done, the operator recycles the balance operation to prove accuracy.

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Blakeslee & Co., G. S. 64
Bliss Co., E. W. —
Borg & Beck Div. —
Borg-Warner Corp. —
Bower Roller Bearing Co. —
Box 58 —
Brad-Foote Gear Works —
Bruning Co., Inc., Charles —
Buell Manufacturing Co. —
Builders Steel Supply Co. 64
Bullard Company —
Bundy Tubing Company —
Bunting Brass & Bronze Co. —

Campbell, Wyant & Cannon Foundry Co. —
Carboloy Company, Inc. —
Carnegie-Illinois Steel Corp. —
Central Screw Co. —
Central Sheet Metal Works, Inc. —
Central Steel & Wire Co. —
Chambersburg Engineering Co. —
Chicago Rawhide Mfg. Co. —
Cincinnati Milling Machine Co. —
Cincinnati Tool Co., The —
Clark Equipment Co. 60
Classified Advertisements 61
Clearing Machine Corp. —
Cleveland Punch & Shear Wks. Co. —
Clifford Manufacturing Co. —
Columbia Steel Co. —
Commander Mfg. Co. —
Continental - Diamond Fibre Co. —
Continental Motors Corp. —
Continental Screw Co. —
Continental Tool Works —
Corbin Screw Div. —
Cotta Transmission Co. —
Cross Company, The —

Danly Machine Specialties, Inc. 1
Detrex Corporation —
Disston & Sons, Inc., Henry —
Dole Valve Co., The —
Donaldson Co., The —
Dow Corning Corp. —
Dunbar Brothers Co. Div. —
du Pont de Nemours & Co., Inc., E. I. —
Dykem, Co., The —

Eaton Manufacturing Co. —
Elco Tool & Screw Corp. —
Electric Auto-Lite Co., The —
Electric Furnace Co., The —
Electric Storage Battery Co. —
Elwell-Parker Electric Co. —
Essex Wire Corp. —
Ex-Cell-O Corp. —
Excelsior Leather Washer Mfg. Co., Inc. —

Fairfield Mfg. Co. —
Federal-Mogul Corp. —
Federated Metals Div. —
Felters Co., The —
Fitzgerald Mfg. Co., The —
Foote Bros. Gear & Machine Corp. —
Ford Motor Co. —
Fuller Manufacturing Co. —

G & O Mfg. Co., The —
Gabriel Company 59
Gairing Tool Co., The —
Galland-Henning Mfg. Co. —
Gardner Machine Co. —
Garrett Co., Inc., Geo. K. —
Gast Manufacturing Corp. —
Gear Grinding Machine Co. —
General Controls —
General Electric Company —
Gibson Co., Wm. D. —
Gisholt Machine Co. 6
Globe-Union, Inc. —
Goodrich Chemical Co., B. F. —
Great Lakes Steel Corp. —
Greenlee Bros. & Co. —
Gunite Foundries —

Handy & Harman —
Hannifin Corp. 64
Hanson-Van Winkle-Munning Co. —
Harper Co., The H. M. —
Heald Machine Co., The —
Herbrand Division, The Bingham-Herbrand Corp. —
Hoover Ball & Roller Bearing Co. —

Houde Engineering Div. —
Houghton & Co., E. F. —
Howell Electric Motors Co. —
Hyatt Bearings Div. —

Illinois Coil Spring Co. —
Inland Manufacturing Div. —
Inland Steel Company —
International Nickel Co., Inc. 2

Jiffy Mfg. Co. —
Johnson Bronze Co. —
Jones & Laughlin Steel Corp. 7

Kelsey-Hayes Wheel Co. —
Kent-Owens Machine Co. —
Kester Solder Co. —
King-Seeley Corp. —
Kopp Glass, Inc. 61

Lake Erie Engineering Corp. —
Lamb Electric Company —
Lamson & Sessions Co. —
Layne & Bowler, Inc. —
Leeds & Northrup Co. —

Index to

The Advertisers' Index is published of the advertising contract. Every rectly. No allowance will be made

Lewis Spring & Mfg. Co. —
Lipe-Rollway Corp. —
Littelfuse, Inc. —
Littell Machine Co., F. J. —
Long Manufacturing Div. —
Lord Manufacturing Co. —
Lyon Metal Products, Inc. —

Magnaflux Corp. —
Mahon Co., The R. C. —
Mallory & Co., Inc., P. R. —
Marsh Stencil Machine Co. —
Mattison Machine Works —
Mechanics Universal Joint Div. —
Merz Engineering Co. —
Michigan Steel Tube Products Co. —

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Midland Steel Products Co. —
Milford Rivet & Machine Co. —
Milsco Manufacturing Co. —
Moline Tool Company —
Moore, Inc., George W. —
Moraine Products Div. —
Morse Chain Co. —
Muskegon Piston Ring Co. —

Nadella —
National Acme Co., The 5
National Broach & Machine Co. —
National Formetal Co., Inc. —
National Lock Co. —
National Motor Bearing Co. —
National Screw & Mfg. Co., The 57
New Britain Machine Co. —
New Departure Div. —
New England Screw Co. —
Newcomb-Detroit Co. —
Nikoh Tube Company —
Norton Company —

Page Steel & Wire Div., Amer. Chain & Cable Co., Inc. —
Palnut Company, The —
Pannier Corporation, The —
Parker-Kalon Corp. —
Parker Rust Proof Co. —
Pawtucket Screw Co. —
Pedrick Piston Rings —
Peninsular Grinding Wheel Co. —
Permatex Co., Inc. —
Peters-Dalton, Inc. —
Pheoll Mfg. Co. —
Phillips Screw Mfrs. —
Piasecki Helicopter Corp. —
Pierce Governor Co., Inc. —
Polk & Co., R. L. —
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Pratt & Whitney Div., Niles-Bement-Pond Company —

Ramsey Corporation ..Back Cover
Raybestos-Manhattan, Inc. (Equipment Sales Div.) —
Raymond Mfg. Co. —
Reading Screw Co. —
Redmond Co., Inc. —
Reeves Bros., Inc. —
Revere Copper & Brass, Inc. —
Reynolds Metals Co. —
Reynolds Wire Company —
Richards Co., J. A. —
Rockford Clutch Div. 58
Rockford Magnetic Products Co., Inc. —
Rockford Screw Products Co. —
Ross Gear & Tool Co. —
Russell, Burdsall & Ward Bolt & Nut Co. —
Ryerson & Son, Inc., Joseph T. —

SKF Industries, Inc. —
Saginaw Div., Eaton Mfg. Co. —
Saginaw Steering Gear Div. —
Schmieg Industries, Inc. —
Schrader's Son, A. —
Schwitzer-Cummins Co. —
Scovil Mfg. Co. —
Sealed Power Corporation —
Seaboard Screw Corp. —
Seneca Falls Machine Co. —
Service Spring Co. —
Shakeproof, Inc. —
Shore Instrument & Mfg. Co. —
Shuler Axle Co. —
Simonds Abrasive Co. —
Snow Mfg. Co. —
Snyder Tool & Engineering Co. —
Southington Hardware Mfg. Co. —
Spicer Mfg. Div. Dana Corp. —
Standard Oil Co. (Ind.) ..2nd Cover
Standard Pressed Steel Co. —
Standard Products Co. —
Standard Tube Co. —
StéAme des Roulements A Aiguilles —
Steel Co. of Canada, Ltd., The —
Sterling Aluminum Products, Inc. —
Sterling Bolt Co. —
Strom Steel Ball Co. —
Stronghold Screw Products, Inc. —
Stuart Oil Co., Ltd., D. A. —
Sun Oil Company 11
Sunstrand Machine Tool Co. —
Superior Steel Corp. —

Tennessee Coal, Iron & R. R. Co. —
Texas Company, The —
Thompson-Bremer & Co. —
Thompson Products, Inc. —
Timken Roller Bearing Co., The —
Titeflex, Inc. —
Tomkins-Johnson Company, The —
Torrington Co., The —
Tourek Mfg. Co., J. J. —
Towmotor Corp. —
Trico Products Corporation —
Tung-Sol Lamp Works, Inc. —
Tuthill Pump Co. —
Tuthill Spring Co. —

Union Carbide & Carbon Corp. —
Unitcast Corp. —
United Specialties Company 64
United States Rubber Co. —
United States Steel Co. —

Vanadium Corp. of Amer. —
Verson Allsteel Press Co. —
Vickers, Inc. —
Victor Manufacturing & Gasket Co. —

Waldes-Kohinoor, Inc. —
Wales-Beech Corp. —
Waukesha Motor Company —
Western Felt Works 64
Westinghouse Electric Corp. —
Wilkening Mfg. Company —
Williams & Co., J. H. —
Wilson Co., The H. A. —
Wisconsin Motor Corp. —
Wolverine Bolt Co. —
Wood Co., R. D. —
Worcester Stamped Metal Co. 64
Wrought Washer Mfg. Co. —
Wyman-Gordon —

Yates-American Machine Co. —
Young Radiator Company 3

Zollner Machine Works..3rd Cover

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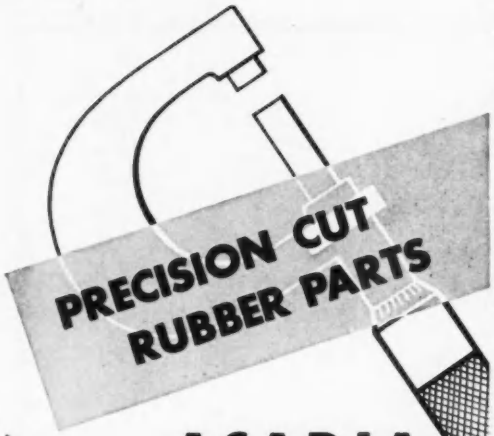

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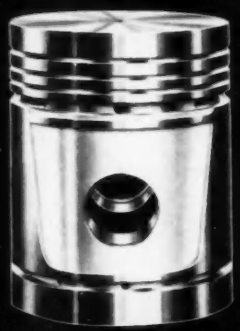

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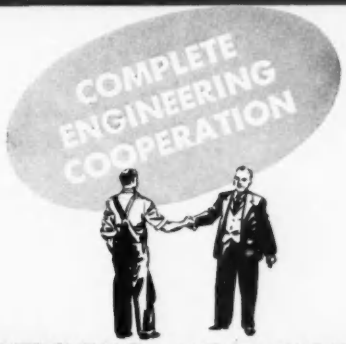

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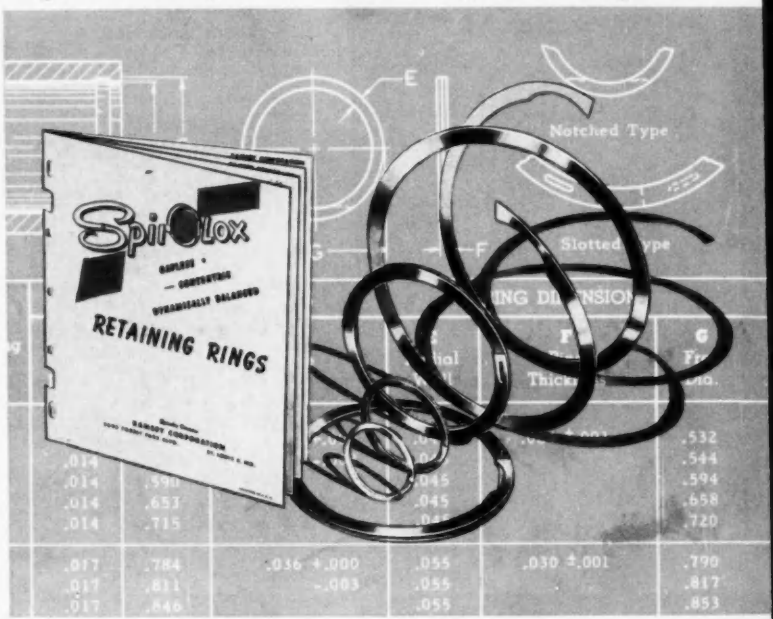

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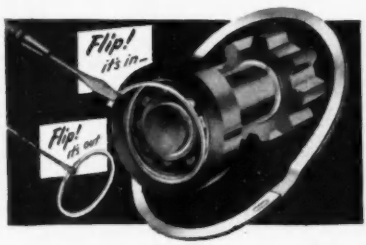

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